

# Chapter 14

## Measurement

### Looking Back

#### Length

It takes Mayank 10 minutes to walk 1 km. You have already learnt that :

$$100 \text{ cm} = 1 \text{ m}$$

$$1000 \text{ m} = 1 \text{ km.}$$

#### Mass

Kilograms (kg) is used to weigh heavier objects and grams (g) to weigh lighter ones.

$$1000 \text{ g} = 1 \text{ kg}$$

#### Capacity

Litre (l) is used to measure larger quantities of liquid and millilitres (ml) is used to measure smaller quantities.

### MEASUREMENT OF LENGTH

#### Place-value chart for prefixes

The basic unit of length is metre. It is represented as m. Prefixes like kilo, deca, milli, centi, etc. are unit of multiples of 10.

Below given is a place -value chart which will help you to understand these prefixes more better.

Place value	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
Prefix	kilo	hecto	deca		deci	centi	mili

#### Relating metre to other units :

More than a metre	kilometre (km)	$(m \div 1000)$
	↑	
	hectometre (hm)	$(m \div 100)$
	↑	
	↑	
	↑	
	metre	(m)
Less than a metre	↓	
	decimetre (dm)	$(m \times 10)$
	↑	
	centimetre (cm)	$(m \times 100)$
	↑	
	millimetre (mm)	$(m \times 1000)$

This show that :

$$1,000 \text{ m} = 1 \text{ km (kilometre)}$$

$$1,000 \text{ mm (millimetre)} = 1 \text{ m}$$

$$100 \text{ m} = 1 \text{ hm (hectometre)}$$

$$100 \text{ cm (centimetre)} = 1 \text{ m}$$

$$10 \text{ m} = 1 \text{ dam (decametre)}$$

$$10 \text{ dm (decimetre)} = 1 \text{ m}$$

**Millimetre** is the smallest unit of length that you will learn about. **If one centimetre is divided into 10 parts, then each part is a millimetre.** A millimetre is a very small unit. The breadth of hour-hand on a watch will be about one millimetre.

### Rules for relating metre to other units

**Rules 1 :** To change from a bigger unit to a smaller unit, multiply. The prefixes will help you remember what to multiply by.

**Bigger**  $\longrightarrow$  **Smaller**

$$\text{km} \longrightarrow \text{m} (\times 1000)$$

$$\text{hm} \longrightarrow \text{m} (\times 100)$$

$$\text{dam} \longrightarrow \text{m} (\times 10)$$

$$\text{m} \longrightarrow \text{mm} (\times 1000)$$

$$\text{m} \longrightarrow \text{cm} (\times 100)$$

$$\text{m} \longrightarrow \text{dm} (\times 10)$$

**Remember:**

**Rule-1: BSM**

Big to Small – Multiply

**Rule 2 :** To change from a smaller unit to a bigger unit, divide.

**Smaller**  $\longrightarrow$  **Bigger**

$$\text{m} \longrightarrow \text{km} (\div \text{by } 1000)$$

$$\text{m} \longrightarrow \text{hm} (\div \text{by } 100)$$

$$\text{m} \longrightarrow \text{dam} (\div \text{by } 10)$$

$$\text{mm} \longrightarrow \text{m} (\div \text{by } 1000)$$

$$\text{cm} \longrightarrow \text{m} (\div \text{by } 100)$$

$$\text{dm} \longrightarrow \text{m} (\div 10)$$

**Remember:**

**Rule-2: SBD**

Small to Big – Divide

**Observe the following examples :**

(a)  $32.8 \text{ km} = ? \text{ m}$

$$32.8 \times 1000 = 32800$$

**Answer :**  $32.8 \text{ km} = 32,800 \text{ m}$ .

(b)  $6.3 = ? \text{ mm}$

$$6.3 \times 1000 = 6300$$

**Answer :**  $6.3 \text{ m} = 6,300 \text{ mm}$

(c)  $91.4 \text{ dm} = ? \text{ m}$

$$91.4 \times 10 = 914$$

**Answer :**  $91.4 \text{ dm} = 91.4 \text{ m}$



## Testing Time 14.1

### 1. Fill in the blanks:

- (a)  $125.2 \text{ km} = \underline{\hspace{2cm}} \text{ m}$       (b)  $125.2 \text{ hm} = \underline{\hspace{2cm}} \text{ m}$   
 (c)  $125.2 \text{ dam} = \underline{\hspace{2cm}} \text{ m}$       (d)  $125.2 \text{ dm} = \underline{\hspace{2cm}} \text{ m}$   
 (e)  $125.2 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$       (f)  $125.2 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$

### 2. Express the following measures in metres:

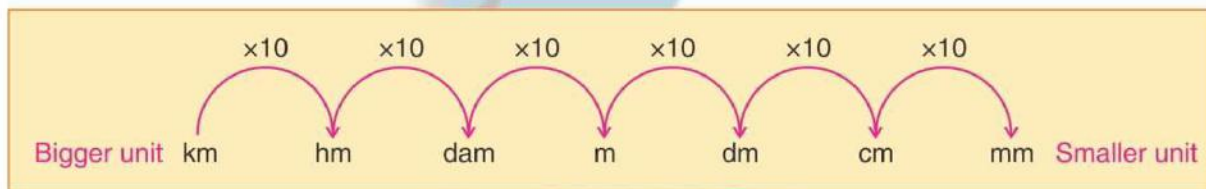
- (a) 711 cm      (b) 12.5 dam  
 (c) 789 dm      (e) 2.09 hm

## RELATING ALL UNITS OF LENGTH

### Conversion between units

In the earlier section, we related all the units of length to the base unit 'metre'. Now we shall relate all the units to each other. The rules learnt earlier will apply here, too.

**Rule 1 :** To change from a bigger unit to smaller one, multiply by 10 for each move to the right.

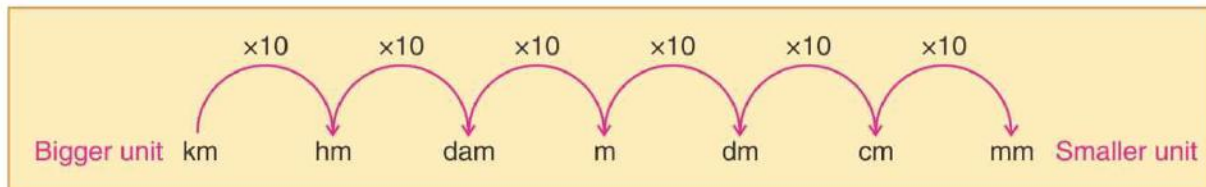


- (a)  $15.8 \text{ km} = ? \text{ hm}$       (b)  $27.6 \text{ dam} = ? \text{ cm}$   
 $15.8 \times 10 = 158$        $27.6 \times 1000 = 27600$

**Answer :**  $15.8 \text{ km} = 158 \text{ hm}$ .

**Answer :**  $27.6 \text{ dam} = 27600 \text{ cm}$ .

**Rule 2 :** To change from a smaller unit to a bigger one, divided by 10 for each move to the left.



- (a)  $375 \text{ mm} = ? \text{ cm}$       (b)  $86.1 \text{ dm} = ? \text{ hm}$   
 $375 \div 10 = 37.5$        $86.1 \div 1000 = 0.0861$

**Answer :**  $375 \text{ mm} = 37.5 \text{ cm}$ .

**Answer :**  $86.1 \text{ dm} = 0.0861 \text{ hm}$

This ready table will help you check if you have got the relationship right.

To change	From mm	From cm	From dm	From m	From dam	From hm	From km
To mm		×10	×100	×1000	×10000	×100000	×1000000
To cm	÷10		×10	×100	×1000	×10000	×100000
To dm	÷100	÷10		×10	×100	×1000	×10000
To m	÷1000	÷100	÷10		×10	×100	×1000
To dam	÷10000	÷1000	÷100	÷10		×10	×100
To hm	÷100000	÷10000	÷1000	÷100	÷10		×10
To km	÷1000000	÷100000	÷10000	÷1000	÷100	÷10	

### Use a short - cut method

To change 327.8 cm to m.

**Step 1 :** Fit in the cm in the metric system chart.

$$\begin{array}{cccc} \frac{\text{m}}{3} & \frac{\text{dm}}{2} & \frac{\text{cm}}{7} & \frac{\text{mm}}{8} \end{array}$$

**Step 2 :** Move the decimal to the place immediately after the metres place.

$$\begin{array}{cccc} \frac{\text{m}}{3} & \frac{\text{dm}}{2} & \frac{\text{cm}}{7} & \frac{\text{mm}}{8} \end{array}$$

**Answer :** 327.8 cm = 3.278 m.

Observe the following example :

Change 73.65 m to km.

**Step 1 :** Fit in the metres in the metric system chart.

$$\begin{array}{cccccc} \text{km} & \text{hm} & \frac{\text{dam}}{7} & \frac{\text{m}}{3} & \frac{\text{dm}}{6} & \frac{\text{cm}}{5} \end{array}$$

**Step 2 :** Shift the decimal to the place immediately after the kilometres place.

$$\begin{array}{cccccc} \frac{\text{km}}{0} & \frac{\text{hm}}{0} & \frac{\text{dam}}{7} & \frac{\text{m}}{3} & \frac{\text{dm}}{6} & \frac{\text{cm}}{5} \end{array}$$

**Answer :** 73.65 m = 0.07365 km.

### Different ways of expressing length

We can express the same length using the bigger unit or smaller unit. While going to school, a boy travels 4 km 132 m in the bus. When he returns, he travels 4.123 km.

This shows that 4 km 132 m, 4.132 km and 4132 m are all different ways of expressing the same length.

In the same way, 14 m 98 cm can be expressed in the bigger unit as 14.98 m or in the smaller unit as 1498 cm.

Also, 85 cm 5 mm = 85.5 cm or 855 mm.



### Testing Time 14.2

#### 1. Convert the following :

- (a) 35 mm to dam      (b) 13.2 mm to cm      (c) 37 dam to dm      (d) 154 cm to dm

#### 2. Use the short-cut method to convert the following :

- (a) 43.2 km to m      (b) 52.77 cm to m      (c) 69.2 m to mm      (d) 163 mm to cm

#### 3. Compare using >, < or = :

- (a) 7 km  70 m      (b) 6000 mm  6m  
(c) 80 cm  8m      (d) 769 km  7.69 m

#### 4. Complete the table:

km	hm	dam	m	dm	cm	mm
0.006	0.06	0.6	6	60	600	6000
	0.42					
		7.3				
					96	
				80		
			5.9			

#### 5. Solve the following :

- (a) Prity has placed a stool on a table to reach the atop of her clipboard. If the height of the table is 88 cm and the stool is 55 cm, at what height in metres is Prity standing ?  
(b) Vicky runs 4.2 km a day. How far does Vicky run in a week ?  
(c) A rabbit's hop is about 2 m long. How many hops does it take to travel 1 km?

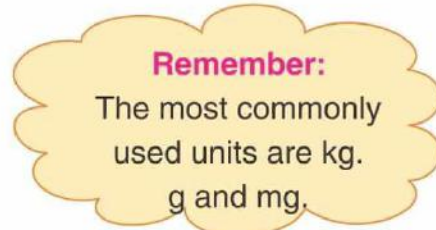
## MEASUREMENT OF MASS

The basic unit of mass in the metric system is 'gram' and is represented as 'g'. Prefixes similar to the measurement of length are used to relate to the basic unit.

Which means the same as mass.

### Relating gram to other units

<b>heavier than a gram</b>	[	Kilogram (kg)      ( $g \div 1000$ )
		↑
		hectogram (hg)      ( $g \div 100$ )
		↑
		decagram (dag)      ( $g \div 10$ )
		↑
		gram (g)
<b>Lighter than a gram</b>	[	↓
		decigram (dg)      ( $g \times 10$ )
		↓
		centigram (cg)      ( $g \times 100$ )
		↓
		milligram (mg)      ( $g \times 1000$ )



This shows that ;

$$\begin{array}{ll} 1,000 \text{ g} = 1 \text{ kg} & 10 \text{ dg} = 1 \text{ g} \\ 100 \text{ g} = 1 \text{ hg} & 100 \text{ cg} = 1 \text{ g} \\ 10 \text{ g} = 1 \text{ dag} & 1000 \text{ mg} = 1 \text{ g} \end{array}$$

### Rules for relating gram to other units :

**Rule 1 :** Bigger unit to smaller unit, multiply.

**Rule 2:** Smaller unit to bigger unit, divide.

(a)  $35 \text{ kg} = ? \text{ g}$

$$35 \times 1000 = 35000$$

**Answer :**  $35 \text{ kg} = 35,000 \text{ g}$ .

(b)  $17,300 \text{ mg} = ? \text{ g}$

$$17300 \div 1000 = 17.300$$

**Answer :**  $17,300 \text{ mg} = 17.300 \text{ g}$ .



### Testing Time 14.3

#### Fill in the blanks :

(a)  $16 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$

(b)  $7.500 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

(c)  $2.04 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

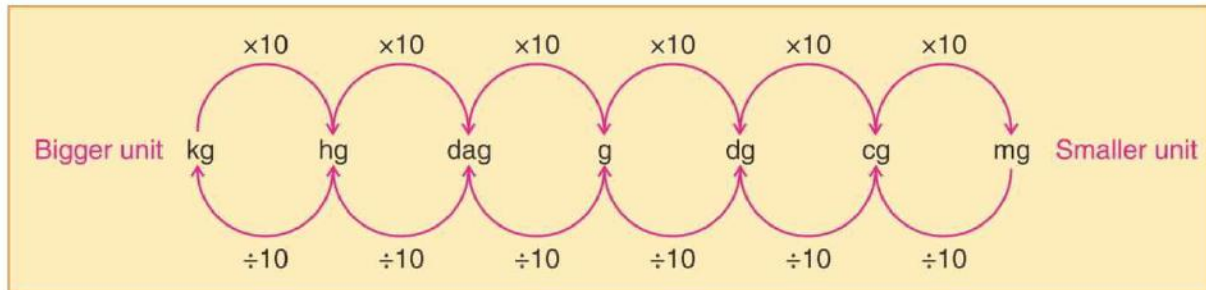
(d)  $804 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

## RELATING ALL UNITS OF MASS

### Conversion between units

**Rule 1 :** To change from a bigger to a smaller unit, multiply by 10 for each move to the right.

**Rule 2 :** To change from a smaller to a bigger unit, divide by 10 for each move to the left.



(a)  $394.4 \text{ hg} = ? \text{ dag}$

$$394.4 \times 10 = 3944$$

**Answer:**  $394.4 \text{ hg} = 3944 \text{ dag}$ .

(b)  $5,280 \text{ mg} = ? \text{ dg}$

$$5280 \div 100 = 52.80$$

**Answer:**  $5280 \text{ mg} = 52.8 \text{ dg}$ .

The decimal short-cut method shown in measurement of length can be used here, too.

### Expressing mass in different ways

As with length, mass can also be expressed in different ways.

Observe the following examples :

(a) 4 kg 163 g can be expressed as 4,163 (bigger unit) and 4,163 g (smaller unit).

(b) In the same way, 1,938 g can be expressed as 1.938 kg or 1 kg 938g.



### Testing Time 13.4

#### 1. Fill in the blanks :

(a)  $19 \text{ hg} = \underline{\hspace{2cm}} \text{ dg}$

(b)  $13.8 \text{ kg} = \underline{\hspace{2cm}} \text{ hg}$

(c)  $1.3 \text{ dag} = \underline{\hspace{2cm}} \text{ g}$

(d)  $170 \text{ cg} = \underline{\hspace{2cm}} \text{ g}$

(e)  $240 \text{ hg} = \underline{\hspace{2cm}} \text{ dg}$

(f)  $153 \text{ dg} = \underline{\hspace{2cm}} \text{ dag}$

#### 2. Fill in the blanks :

(a)  $17.386 \text{ kg} = \underline{\hspace{2cm}} \text{ kg} \underline{\hspace{2cm}} \text{ g}$

(b)  $0.732 \text{ kg} = \underline{\hspace{2cm}} \text{ kg} \underline{\hspace{2cm}} \text{ g}$

(c)  $24 \text{ kg } 13 \text{ g} = \underline{\hspace{2cm}} \text{ g}$

(d)  $76 \text{ kg } 10 \text{ g} = \underline{\hspace{2cm}} \text{ g}$

(e)  $2,346 \text{ g} = \underline{\hspace{2cm}} \text{ kg} \underline{\hspace{2cm}} \text{ g}$

(f)  $12,376 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

3. Solve the following :

- (a) Neha weighs 35.4 kg and Manju weighs 42.9 kg. If Aashish, Neha and Manju weigh 117 kg altogether, what is Aashish's weight?
- (b) Rahul is 7.06 kg lighter than Saurav. Saurav weighs 62.3 kg. How much does Rahul weigh?

**MEASUREMENT OF LIQUID CAPACITY**

The basic unit of liquid capacity in the metric system is 'litre' which is represented as 'l'. Prefixes similar to measurement of length are used to relate to the basic unit.

More than a litre	[	Kilolitre (kl)	$(l \div 1000)$
		hectolitre (hl)	$(l \div 100)$
		decalitre (dal)	$(l \div 10)$

litre (l)

Less than a litre	[	decilitre (dl)	$(l \div 10)$
		centilitre (cl)	$(l \div 100)$
		millilitre (ml)	$(l \div 1000)$

This shows that ;

$$1,000\text{ l} = 1\text{ kl} \quad 10\text{ dl} = 1\text{ l}$$

$$100\text{ l} = 1\text{ hl} \quad 100\text{ cl} = 1\text{ l}$$

$$10\text{ l} = 1\text{ dal} \quad 1000\text{ ml} = 1\text{ l}$$

**Rules for relating litre to other units**

The same rules apply for conversion of capacity as it does for measurement of length and mass.

**Rule 1:** To change from a bigger unit to a smaller unit, **multiply**.

**Rule 2:** To change from a smaller unit to bigger unit, **divide**.

(a)  $53.5\text{ l} = ?\text{ ml}$

$$53.5 \times 1000 = 53500$$

**Answer :**  $53.5\text{ l} = 53,500\text{ ml}$ .

(b)  $68,400\text{ l} = \text{kl}$

$$68400 \div 1000 = 68.4$$

**Answer:**  $68,400\text{ l} = 68.4\text{ kl}$

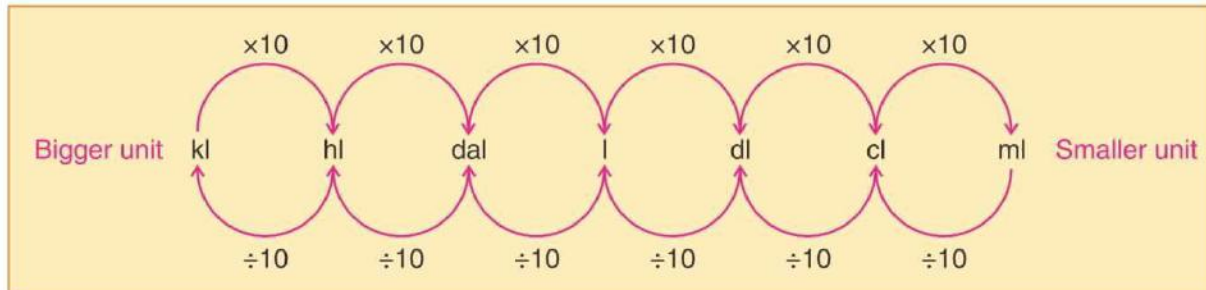


### Conversion between all units

Apply the same rules as you did for the measurement of length and mass.

**Rule 1 :** To change from a bigger unit to smaller one, multiply by 10 for each more to the right.

**Rule 2 :** To change from a smaller unit to a bigger one, divide by 10 for each more the left.



(a)  $39 \text{ kl} = \text{dal}$

$$39 \times 100 = 3900$$

Answer:  $39 \text{ kl} = 3,900 \text{ dal}$

(b)  $14,500 \text{ ml} = ? \text{ l}$

$$14500 \div 1000 = 14.500$$

Answer:  $14,500 \text{ ML} = 14.5 \text{ l}$

### Expressing capacity in different ways

As with length and mass, capacity can be expressed in different ways.

Reeta bought a soft drink bottle of 1.250 l capacity and Seema bought one with a capacity of 1 l 250 ml. Both bottles contain the same amount as both are different ways of expressing the same quantity. For example,

$$1.250 \text{ l} = 1 \text{ l } 250 \text{ ml} = 1,250 \text{ ml}$$



### Testing Time 13.5

#### 1. Fill in the blanks :

(a)  $1,842 \text{ ml} = \underline{\hspace{1cm}} \text{ l}$

(b)  $10.6 \text{ kl} = \underline{\hspace{1cm}} \text{ l}$

(c)  $2.5 \text{ kl} = \underline{\hspace{1cm}} \text{ ml}$

(d)  $15.35 \text{ l} = \underline{\hspace{1cm}} \text{ ml}$

(e)  $2,350 \text{ l} + \underline{\hspace{1cm}} \text{ kl}$

(f)  $8.03 \text{ l} = \underline{\hspace{1cm}} \text{ ml}$

#### 2. Fill in the blanks :

(a)  $8.5 \text{ dal} = \underline{\hspace{1cm}} \text{ l}$

(b)  $930 \text{ dl} = \underline{\hspace{1cm}} \text{ ml}$

(c)  $8.600 \text{ hl} = \underline{\hspace{1cm}} \text{ l}$

(d)  $5.08 \text{ cl} = \underline{\hspace{1cm}} \text{ ml}$

(e)  $17.3 \text{ ml} = \underline{\hspace{1cm}} \text{ l}$

(f)  $80.1 \text{ l} = \underline{\hspace{1cm}} \text{ dal}$

**3. Solve the following :**

- (a) A teapot holds about 900 ml of tea. How many tea cups of 150 ml each can it fill ?  
 (b) A shower drips at the rate of 150 ml an hour. How many litres of water would drip from it in 8 hours?

**ADDING AND SUBTRACTING METRIC MEASURES**

**Adding measures of length**

**Adding the same unit**

(a) Two sheets of thick paper of thickness 6 mm and 8 mm respectively were stuck one on top of the other. What is the thickness of the paper now ?

$$\begin{array}{r} 6 \text{ mm} \\ + 8 \text{ mm} \\ \hline 14 \text{ mm} = 1 \text{ cm } 4 \text{ mm} \end{array}$$

**Answer :** The paper is now 1 cm 4 mm thick.

(b)  $25 \text{ cm} + 86 \text{ cm} + 30 \text{ cm}$

$$\begin{array}{r} 25 \text{ cm} \\ 86 \text{ cm} \\ + 30 \text{ cm} \\ \hline 141 \text{ cm} = 1 \text{ m } 41 \text{ cm.} \end{array}$$

**Adding different units :**

A boy drew a line 9 cm 7 mm long with a blue pencil and then extended it by a red line of 5 cm 8 mm. What was the length of the whole line ?

$$\begin{array}{r} 9 \text{ cm} \quad 7 \text{ mm} \\ + 5 \text{ cm} \quad 8 \text{ mm} \\ \hline \end{array}$$

(1 cm)

$$\begin{array}{r} 9 \text{ cm} \quad 7 \text{ mm} \\ + 5 \text{ cm} \quad 8 \text{ mm} \\ \hline \quad \quad 5 \text{ mm} \end{array}$$

(1 cm)

$$\begin{array}{r} 9 \text{ cm } 7 \text{ mm} \\ + 5 \text{ cm} \quad 8 \text{ mm} \\ \hline 15 \text{ cm} \quad 5 \text{ mm} \end{array}$$

**Answer :** The length of the whole line was 15 cm 5 mm.

### Adding measures of mass (weight)

A shopkeeper bought 3 coconuts at the market. One coconut weighed 210g another coconut was 318 g and the third coconut weighed 250 g. What did the three coconuts weigh?

$$\begin{array}{r} 210 \text{ g} \\ 318 \text{ g} \\ + 250 \text{ g} \\ \hline 778 \text{ g} \end{array}$$

**Answer :** The weight of 3 coconuts was 778 g.

### Adding measures of capacity

Priya was making orange juice for a party. She used 300 ml of orange squash and added 750 l of water to it. How much orange juice has she made ?

(a)

$$\begin{array}{r} 300 \text{ ml} \\ + 750 \text{ ml} \\ \hline 1050 \text{ ml} = 1 \text{ l } 50 \text{ ml} \end{array}$$

**Answers :** Priya made 1 l 50 ml of orange juice :

### Subtracting units of measure

Riya had a length of a cloth-piece 6 m 16 cm long. Poonam had length of cloth-piece 3 m 75 cm long. How much more cloth-piece did Riya have than Poonam?

$$\begin{array}{r} 6 \text{ m } 16 \text{ cm} \\ - 3 \text{ m } 75 \text{ cm} \\ \hline \end{array} \quad \begin{array}{l} \text{[Since we cannot subtract 75 cm from 16 cm.} \\ \text{we need to regrouping 1 m to 100 cm.]} \end{array}$$
  

$$\begin{array}{r} 6 \text{ m } 16 \text{ cm} \\ - 3 \text{ m } 75 \text{ cm} \\ \hline 2 \text{ m } 41 \text{ cm} \end{array}$$

**Answers:** Riya had 2 m 41 cm more cloth-piece than Poonam.



### Testing Time 13.6

#### 1. Add:

- |                               |                               |
|-------------------------------|-------------------------------|
| (a) 276 m + 740 m + 499 m     | (b) 15 cm 3 mm + 17 cm 7 mm   |
| (c) 39 m 16 cm + 11 m 32 cm   | (d) 8 cm 3 mm + 17 cm 7 mm    |
| (e) 17 m 300 mm + 15 m 800 mm | (f) 19 km 520 m + 41 km 860 m |

**2. Subtract :**

- (a)  $8\text{ cm } 3\text{ mm} - 3\text{ cm } 8\text{ mm}$                       (b)  $6\text{ km} - 3\text{ km } 850\text{ m}$   
(c)  $10\text{ m } 32\text{ cm} - 3\text{ m } 20\text{ cm}$                       (d)  $13\text{ m } 200\text{ mm} - 800\text{ mm}$   
(e)  $5\text{ g} - 325\text{ mg}$                                       (f)  $52\text{ kg } 30\text{ g} - 34\text{ kg } 160\text{ g}$

**3. Solve the following :**

- (a) A porter was carrying two bags One weighing  $15\text{ kg } 700\text{ g}$  and the other weighing  $10\text{ kg } 850\text{ g}$ . How much weight was the porter carrying ?
- (b) A snail travelled  $3\text{ m } 32\text{ cm}$  on one day and a  $1\text{ m } 83\text{ cm}$  on the second day. How far had the snail travelled in all ?
- (c) A gold bangle weighing  $5\text{ g}$  was melted. It lost  $150\text{ mg}$  of weight during melting. How much gold was left ?
- (d) A worm climbing up a high tree went  $13$  metres on one day but slipped back by  $3\text{ m } 35\text{ cm}$  in the evening. How far up had the worm reached?
- (e) A runner practise running for  $16\text{ km } 200\text{ m}$  on Tuesday and  $26\text{ km } 650\text{ m}$  on Sunday. How much more did he run on Sunday?

