9 Measures of Length, Weight and Capacity

We'll cover the following key points:

→ Different Units of Measurement

→ Conversion of One Unit into Another Unit

→ Adding and Subtracting Measures

→ Estimating Measures in Length, Weight and Volume (Capacity)

→ Estimating Difference

Do you Remember fundamental concept in previous class:
In class 3rd we learnt

→ Introduction of Measurement of Weight

→ Conversion of Length and Kilograms

→ Introduction And Conversion of Capacity

→ Addition and Subtraction (Kilogram and Gram)

Hi, I'm EeeBee

Still curious?
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Learning Outcomes

By the end of this chapter, students will be able to:

- Understand and use units of measurement for length, such as centimeters (cm), meters (m), and kilometers (km).

- Measure the length of objects using a ruler or measuring tape (e.g., measuring the length of a pencil in centimeters).

- Convert between different units of length (e.g., 1 meter = 100 centimeters).

- Understand and use units of weight such as grams (g) and kilograms (kg) to measure mass.

- Weigh objects using a balance scale or digital scale (e.g., weighing fruits in grams and kilograms).

- Understand and use units of capacity such as liters (L) and milliliters (mL) to measure liquids.

- Convert between different units of capacity (e.g., 1 liter = 1,000 milliliters).

Here are three different groups discussing the various units of measurement.

I want 6 litres milk today.

2 litres more?

I am the tallest with a height of 120 cm.

I am shorter with a height of 90 cm.

My weight is 35 kg.

Mine is 5 kg less.

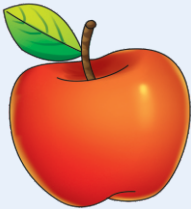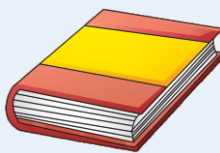**Tick (✓) the approximate measure.**

(a) 10 ml ☐ / 500 ml ☐
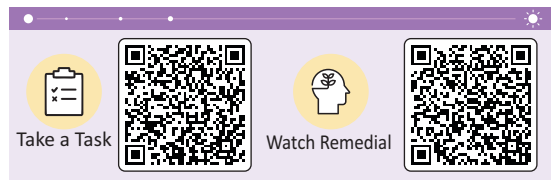
(b) 10 ml ☐ / 15 L ☐

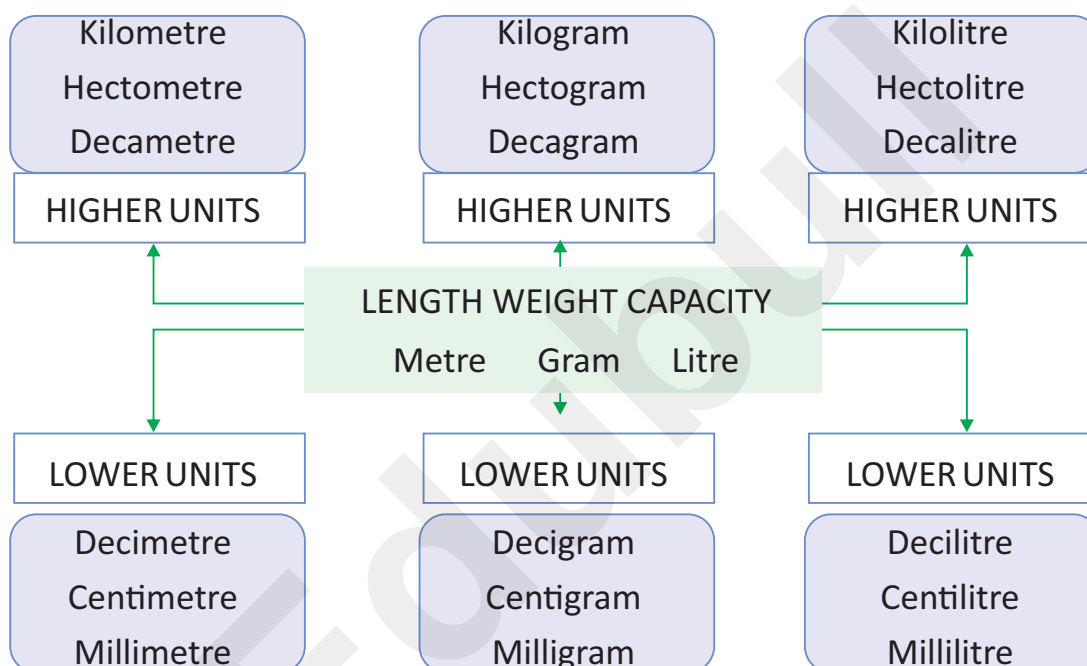(c) 10 kg ☐ / 100 g ☐

(d) 100 g ☐ / 1 kg ☐

Different Units of Measurement

The length, mass and capacity are basic measurements. The standard units of length, mass and capacity are metre (m), gram (g) and litre (*l*) respectively. Length is measured in kilometre, metre and centimetre. Weight is measured in kilogram and gram. Capacity is measured in litre and millilitre.

We know that,   100 cm = 1 m   1000 g = 1 kg   1000 m*l* = 1 litre

We need some more units of measurement for finding more accurate weights. So, we extend this system of metric measurement to units higher than the basic (standard) units as well as units lower than basic units of length, weight and capacity.

Kilometre Hectometre Decametre	Kilogram Hectogram Decagram	Kilolitre Hectolitre Decalitre
HIGHER UNITS	HIGHER UNITS	HIGHER UNITS

LENGTH WEIGHT CAPACITY

Metre   Gram   Litre

LOWER UNITS	LOWER UNITS	LOWER UNITS
Decimetre Centimetre Millimetre	Decigram Centigram Milligram	Decilitre Centilitre Millilitre

Look at the following table :

Place Value Chart						
Thousands	**Hundreds**	**Tens**	**Ones**	**Tenths**	**Hundredths**	**Thousandths**
1000	100	10	1	$\dfrac{1}{10}$	$\dfrac{1}{100}$	$\dfrac{1}{1000}$
Kilo...	Hecto...	Deca...		Deci...	Centi...	Milli...
Kilometre	Hectometre	Decametre	Metre	Decimetre	Centimetre	Millimetre
Kilogram	Hectogram	Decagram	Gram	Decigram	Centigram	Milligram
Kilolitre	Hectolitre	Decalitre	Litre	Decilitre	Centilitre	Millilitre

When we move towards left from the standard unit (i.e. metre / gram / litre), each unit is increased by 10 times.

When we move towards right, each unit becomes $\frac{1}{10}$ (one-tenth) of the previous unit. Using this relationship between units, we can make tables which will be more helpful in conversions.

Measures of Length

A relationship between the units of length is given below:

10 millimetres	=	1 centimetre	(10 mm = 1 cm)
10 centimetres	=	1 decimetre	(10 cm = 1 dm)
10 decimetres	=	1 metre	(10 dm = 1 m)
10 metres	=	1 decametre	(10 m = 1 dam)
10 decametres	=	1 hectometre	(10 dam = 1 hm)
10 hectometres	=	1 kilometre	(10 hm = 1 km)

Measures of Weight

A relationship between the units of mass is given below:

10 milligrams	=	1 centigram	(10 mg = 1 cg)
10 centigrams	=	1 decigram	(10 cg = 1 dg)
10 decigrams	=	1 gram	(10 dg = 1 g)
10 grams	=	1 decagram	(10 g = 1 dag)
10 decagrams	=	1 hectogram	(10 dag = 1 hg)
10 hectograms	=	1 kilogram	(10 hg = 1 kg)

Measures of Capacity

(A relationship between the units of capacity is given below:

10 millilitres	=	1 centilitres	(10 ml = 1 cl)
10 centilitres	=	1 decilitre	(10 cl = 1 dl)
10 decilitres	=	1 litre	(10 dl = 1 l)
10 litres	=	1 decalitres	(10 l = 1 da$l$)
10 decalitres	=	1 hectolitre	(10 da$l$ = 1 hl)
10 hectolitres	=	1 kilolitre	(10 hl = 1 kl)

Conversion of One Unit into Another Unit

Using the table showing the relationship between the units, we get

$$10 \text{ mm} = 1 \text{ cm}$$
$$100 \text{ cm} = 1 \text{ m}$$
$$1000 \text{ m} = 1 \text{ km}$$

Similarly, $\quad 10 \text{ mg} = 1 \text{ cg}$

Take a Task

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$$100 \, cg = 1 \, g$$

$$1000 \, g = 1 \, kg$$

Similarly,

$$10 \, ml = 1 \, cl$$

$$100 \, cl = 1 \, litre$$

$$1000 \, ml = 1 \, litre$$

$$1000 \, litres = 1 \, kl$$

Example 1: Convert the following :

(i) 6893 m into km and m

(ii) 5735 ml into litre and ml

Solution: (i) We know that 1000 m = 1 km.

$$6893 \, m = 6000 \, m + 893 \, m \qquad \text{(because 6000 m = 6 km)}$$

$$= 6 \, km + 893 \, m$$

(ii) $5735 \, ml = 5000 \, ml + 735 \, ml$

$$= 5 \, litres + 735 \, ml \qquad \text{(because 5000 ml = 5l)}$$

Example 2: Convert the following :

(i) 2897 mg into g, cg and mg

(ii) 7158 mm into m, cm and mm

Solution : (i) $2897 \, mg = 2000 \, mg + 897 \, mg$

$$= 2 \, g + 897 \, mg \, (\text{Since 2000 mg = 2 g})$$

$$= 2 \, g + 890 \, mg + 7 \, mg$$

$$= 2 \, g + 89 \, cg + 7 \, mg \qquad \text{(Since 10 mg = 1 cg)}$$

$$= 2 \, g \, 89 \, cg \, 7 \, mg$$

(ii) $7158 \, mm = 7000 \, mm + 158 \, mm$

$$= 7 \, m + 150 \, mm + 8 \, mm \qquad \text{(Since 7000 mm = 7 m)}$$

$$= 7 \, m + 15 \, cm + 8 \, mm \qquad \text{(Since 10 mm = 1 cm)}$$

$$= 7 \, m \, 15 \, cm \, 8 \, mm$$

Exercise 9.1

Knowledge Application

1. **Multiple Choice Questions (MCQs)**

Choose the correct option.

(a) Which is the standard unit of length?

(i) Metre ☐   (ii) Millimetre ☐   (iii) Decametre ☐

(b) Which is the standard unit of weight ?

(i) Milligram ☐   (ii) Centigram ☐   (iii) Gram ☐

(c) 10 hectolitres = 1 ....

(i) centilitre ☐   (ii) kilolitre ☐   (iii) litre ☐

2. **Convert the following into kg and g:**

(a) 2535 g   (b) 7289 g   (c) 3000 g

(d) 28993 g   (e) 9780 g   (f) 85405g

3. **Convert the following into g, cg and mg:**

(a) 5253 mg   (b) 1751 mg   (c) 7068 mg

(d) 8214 mg   (e) 3892 mg   (f) 6453 mg.

4. **Convert the following into litres and ml:**

(a) 9000 ml (b) 5016 ml (c) 1258 ml

(d) 2940 ml (e) 8516 ml (f) 9129 ml

5. **Convert the following into km and m :**

(a) 6000 m   (b) 3258 m   (c) 6008 m

(d) 8257 m   (e) 3428 m   (f) 8257 m

Adding and Subtracting Measures

Example 3: Find the sum of :

(i) 40 litres 525 ml and 8 litres 825 ml.

(ii) 31 Kg 780 g and 22 kg 345 g.

(iii) 25 km 678 m and 12 km 375 m.

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Solution: (i) First write the measures in columns, then add them.

litre	ml
1	1
40	525
+ 8	825
49	350

Working

525 ml + 825 ml = 1350 ml.

Now, 1350 ml = [1] litre + 350 ml.

Then, 40 litres + 8 litres + [1] litre = 49 litres

Hence, the required sum is 49 litres 350 ml.

(ii)

kg	g
1	
31	780
+ 22	345
54	125

Working

780 g + 345 g = 1125 g

Now, 1125 g = [1] kg + 125 g

Then, 31 kg + 22 kg + [1] kg = 54 kg

123

Hence, the required sum is 54 kg 125 g.

(iii)
$$
\begin{array}{rr}
\text{Km} & \text{m} \\
\boxed{1} & \\
25 & 678 \\
+12 & 375 \\
\hline
38 & 053 \\
\hline
\end{array}
$$

Hence, the required sum is 35 km 53 m.

Example 4 : Subtract :

(i) 24 litres 325 m*l* from 32 litres 350 m*l*

(ii) 26 km 650 m from 40 km 350 m

(iii) 41 kg 375 g from 62 kg 250 g

Solution : (i) First, write the measures in columns, then subtract them.

$$
\begin{array}{rr}
\text{litre} & \text{m}l \\
32 & 350 \\
-24 & 325 \\
\hline
8 & 025 \\
\hline
\end{array}
$$

Working

678 m + 375 m = 1053 m

Now, 1053 m = $\boxed{1}$ km + 53 m

Then, 25 km + 12 km + $\boxed{1}$ km = 38 Km

Hence, the required difference is 8 litres 25 m*l*.

Working

350 m*l* – 325 m*l* = 25 m*l*

32 litres – 24 litres = 8 litres

(ii)
$$
\begin{array}{rr}
\text{km} & \text{m} \\
40 & 350 \\
-26 & 650 \\
\hline
13 & 700 \\
\hline
\end{array}
$$

Hence, the required difference is 13 km 700 m.

Working

We can't subtract 650 m from 350 m.
Borrow 1 km from 40 km.
So, 40 km – 1 k = 39 km remains.
Now, 1 km + 350 m = 1000 m + 350 m = 1350 m.
1350 m – 650 m = 700 m
Also, 39 km – 26 km = 13 km.

(iii)
$$
\begin{array}{rr}
\text{kg} & \text{g} \\
62 & 250 \\
-41 & 375 \\
\hline
20 & 875 \\
\hline
\end{array}
$$

Hence, the required difference is 20 kg 875 g.

Working

Since 375 g > 250 g, we borrow 1 kg from 62 kg. Hence, 61 kg remain.
Now, 250 g + 1 kg = 250 g + 1000 g = 1250 g
1250 g – 375 g = 875 g
Also, 61 Kg – 41 Kg = 20 kg.

Example 5: There was 86 _l_ 500 m_l_ of water in a tub.
43 _l_ 450 m_l_ of water was used. Find the remaining quantity of water in the tub.

Solution: The quantity of water in the tub is 86 _l_ 500 m_l_.

The quantity of water used is 43 _l_ 450 m_l_.

Therefore, remaining quantity of water in the tub

= 86 _l_ 500 m_l_ − 43 _l_ 450 m_l_

= 43 _l_ 50 m_l_.

$$
\begin{array}{rr}
 & \overset{4}{\cancel{5}}\overset{10}{\cancel{0}}0 \\
86 & 500 \\
-\ 43 & 450 \\
\hline
43 & 050 \\
\end{array}
$$

Example 6: A car covered a distance of 80 km 750 m in one hour and 75 km 350 m in the second hour. Find the total distance covered in the two hours ?
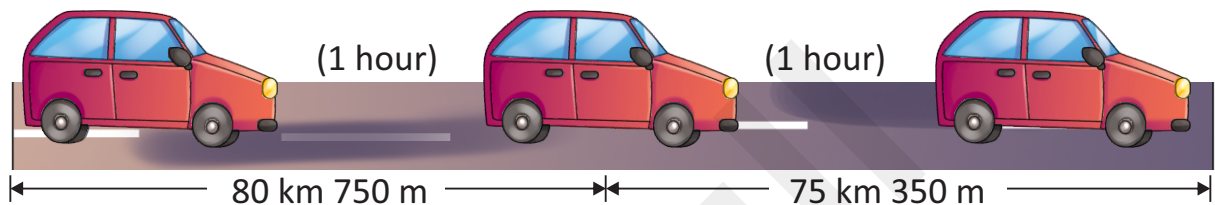
← 80 km 750 m →|← 75 km 350 m →

Solution: Distance covered in the first hour = 80 km 750 m

Distance covered in the second hour = 75 km 350 m

$$
\begin{array}{rr}
80\ \text{km} & 750\ \text{m} \\
+\ 75\ \text{km} & 350\ \text{m} \\
\hline
156\ \text{km} & 100\ \text{m} \\
\end{array}
$$

Distance covered in two hours

Thus, the car covered the distance of 156 km 100 m in two hours.

Example 7: A public distribution shop has 72 kg 375 g of sugar. If 375 kg 500 g more sugar is brought to the shop then how much sugar is there now?

Solution: Quantity of sugar present in shop is 72 kg 375 g

Quantity of sugar brought in shop is 375 kg 500 g

Therefore, the total quantity of sugar in shop

= 72 kg 375 g + 375 kg 500 g

= 447 kg 875 g

$$
\begin{array}{rr}
\text{kg} & \text{g} \\
72 & 375 \\
+\ 375 & 500 \\
\hline
447 & 875 \\
\end{array}
$$

Example 8: There is a rope of 80 m length. If a piece of length 32 m 40 cm is cut from the rope, how much rope is left?

Solution: The length of the rope = 80 m.

The length of the piece of rope that is cut = 32 m 40 cm.

The remaining length of the rope = 80 m − 32 m 40 cm.

$$
\begin{array}{rll}
80\ \text{m} & 00\ \text{cm} & \rightarrow \quad \text{(Put 00 at vacant place of cm)} \\
-\ 32\ \text{m} & 40\ \text{cm} & \\
\hline
47\ \text{m} & 60\ \text{cm} & \\
\end{array}
$$

Hence, the length of remaining rope is 47 m 60 cm.

1. Find the sum of the following:

(a) 25 m 33 cm, 66 m 28 cm.

(b) 23 kg 342 g, 29 kg 695 g.

(c) 27 m 28 cm, 54 m 25 cm, 35 m 26 cm.

2. Subtract the following:

(a) 35 km 250 m from 72 km 780 m.

(b) 55 m 32 cm from 91 m 80 cm.

3. Devendra travelled 75 km 500 m by bus, thereafter 11 km 250 m by auto-rickshaw and finally 5 km 350 m by tonga. What distance did he travel in all ?

4. Megha jumps a length of 3 m 35 cm and Manya jumps a length 45 cm less than Megha. How much does Manya jump?

5. A basket contains 2 kg 500 g sugar, 3 kg 250 g of rice and 5 kg 500 g of pulses. What is the total weight of the basket?

Estimating Measures in Length, Weight and Volume (Capacity)

We have learnt in the earlier chapter how to estimate sum and difference of numbers. Now, we shall use those rules for estimating measures in length, weight and volume.

Take a Task

Estimating Sum

Take a book. Let its length and breadth be 35 cm and 22 cm respectively. Can you estimate the sum of the length and breadth of the book?

Watch Remedial

Clearly, we first round off both the length and breadth (in cm) to the nearest ten, and then add the rounded numbers.

	Estimated Sum	**Actual Sum**
Length : 35 cm	40	35
Breadth : 22 cm	+ 20	+ 22
	60	57

Thus, the estimated sum of the length and breadth of the book is 60 cm.

Clearly, the estimated sum (60 cm) differs from the actual sum (57 cm) by 3 cm (60 cm – 57 cm = 3 cm).

Similarly, we can estimate the sum to measure weight and volume.

Now, let us consider some examples to learn how to estimate these measurements.

Example 9: A man bought 18 kg wheat and 23 kg rice from the market. Estimate the total weight.

Solution: First, we have to round off both the weights to the nearest ten and then add them.

Estimated Sum

$$18 \xrightarrow[\text{the nearest ten}]{\text{rounded to}} 20$$

$$23 \xrightarrow[\text{the nearest ten}]{\text{rounded to}} + 20$$

$$\overline{40}$$

Hence, the estimated total weight of wheat and rice is 40 kg.

Example 10: One bottle contains 175 m*l* mustard oil and another bottle contains 135 m*l* mustard oil. Estimate the total quantity of mustard oil in the two bottles.

Solution: Clearly, to estimate the total quantity of mustard oil, first we have to round off the quantity in each bottle to the nearest ten or hundred and then add.

(i)   Rounding off to the nearest ten

Estimated Sum

$$175 \xrightarrow[\text{the nearest ten}]{\text{rounded to}} 180$$

$$135 \xrightarrow[\text{the nearest ten}]{\text{rounded to}} + 140$$

$$\overline{320}$$

Hence, the total estimated quantity of mustard oil in the two bottles is 320 m*l* (in terms of the nearest ten).

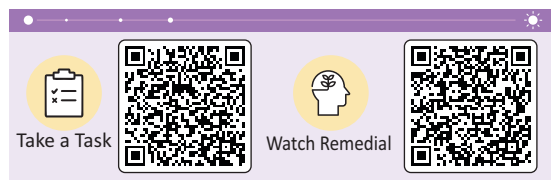(ii)   Rounding off to the nearest hundred

Estimated Sum

$$175 \xrightarrow[\text{the nearest hundred}]{\text{rounded to}} 200$$

$$135 \xrightarrow[\text{the nearest hundred}]{\text{rounded to}} + 100$$

$$\overline{300}$$

Hence, the total estimated quantity of mustard oil in the two bottles is 300 m*l* (in terms of the nearest hundred).
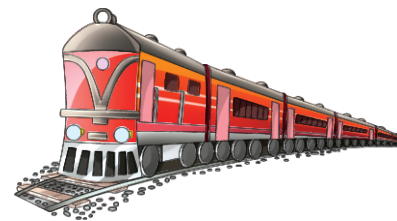
Estimating Difference

Let us consider some examples to learn how to estimate the difference in measuring length, weight and volume.

Take a Task   Watch Remedial

Example 11: A train has to travel a total distance of 574 km. It has already covered a distance of 255 km. Estimate the remaining distance that the train has to travel.

Solution :   To estimate the remaining distance, first we have to round off both the total distance (in km) and distance travelled (in km) to the nearest ten or hundred, and then subtract.

(i)   Rounding off to the Nearest Ten

Estimated Difference

Total distance : 574 km $\xrightarrow[\text{the nearest ten}]{\text{rounded to}}$ 570

Distance travelled : 255 km $\xrightarrow[\text{the nearest ten}]{\text{rounded to}}$ $-\,260$

                                                     310

Hence, the estimated remaining distance is 310 km (in terms of the nearest ten)

(ii)   Rounding off to the Nearest Hundred

Estimated Difference

Total distance : 574 km $\xrightarrow[\text{the nearest hundred}]{\text{rounded to}}$ 600

Distance travelled : 255 km $\xrightarrow[\text{the nearest hundred}]{\text{rounded to}}$ $-\,300$

                                                     300

Hence, the estimated remaining distance is 300 km (in terms of the nearest hundred).

Example 12:   A vessel contains 625 ml of milk and another vessel contains 455 m*l* of milk. Estimate the difference between the quantity of milk between the two vessels in terms of the nearest hundred.

Solution: To estimate the required difference, first we have to round off the quantity of milk (in m*l*) in each vessel to the nearest hundred, and then subtract.

Estimated Difference

625    $\xrightarrow[\text{the nearest hundred}]{\text{rounded to}}$ 600

455    $\xrightarrow[\text{the nearest hundred}]{\text{rounded to}}$ $-\,500$

                                             100

Hence, the estimated difference of the quantity of milk between the two vessels is 100 m*l* (in terms of the nearest hundred).

Answer the following questions:

1. A bottle contains 1335 m*l* of milk and another bottle contains 1215 m*l* of milk. Estimate the sum of the quantity of milk in the two bottles in terms of the nearest hundred.

2. A bag contains 62 kg sugar and another bag contains 85 kg sugar. Estimate the sum of the weights of sugar in the two bags in terms of the nearest ten.

3. The length and breadth of a door are respectively 148 cm and 82 cm. Estimate the sum of the length and breadth of the door in terms of the nearest ten.

4. The lengths of two trains are 535 m and 468 m respectively. Estimate the sum of the lengths of the two trains in terms of the nearest ten.

5. A bottle contains 556 m*l* of oil and another bottle contains 409 m*l* of oil. Estimate the difference in the quantity of oil between the two bottles in terms of the nearest ten.

6. A bag contains 8 kg 455 g sugar and another bag contains 12 kg 605 g sugar. Estimate the difference in the weight (in gram) between the two bags in terms of the nearest thousand.

Project Work

Conceptual Understanding

Prepare a chart of how much amount of milk is being consumed in your home daily. Whenever your mother is using milk, measure the amount of the milk being used and how much is left?

Total milk in the container	Milk being used	Milk left in the container

Mental Math

Critical Thinking

1. Asha was 79 kg 200 g. She reduced her weight by 12 kg 245 g. What is her weight now?

2. Kanchan purchased 12 *l* 40 m*l* of milk. She added 2 *l* 56 m*l* of water in it before boiling. What is the weight of the milk now?

3. The perimeter of a field is 23 km 500 m. If Ram walks around the field 4 times, what will be the distance covered by him?

Think Tank

1. **Tick (✓) the correct answer:**

(a) 7000 g = _____ kg

　(i) 7 ☐ 　(ii) 70 ☐ 　(iii) 7000 ☐ 　(iv) 0.7 ☐

(b) _____ kg = 22000 g

　(i) 220 ☐ 　(ii) 202 ☐ 　(iii) 22 ☐ 　(iv) 2200 ☐

(c) 8500 m*l* = _____ *l*

　(i) 850 ☐ 　(ii) 8.5 ☐ 　(iii) 805 ☐ 　(iv) 85 ☐

(d) 5000 m*l* = _____ *l*

　(i) 50 ☐ 　(ii) 5 ☐ 　(iii) 500 ☐ 　(iv) 5000 ☐

(e) 100 m = _____ cm

　(i) 10 ☐ 　(ii) 100 ☐ 　(iii) 1000 ☐ 　(iv) 10000 ☐

2. **Fill in the blanks:**

(a) 2000 m = _____ km　　　(b) 9 km = _____ m

(c) 9000 m*l* = _____ *l*　　　(d) 3 kg = _____ g

(e) 6 cm = _____ mm　　　(f) 90 mm = _____ cm

(g) 1000 m = _____ km　　　(h) 400 cm = _____ m

(i) 10,000 g = _____ kg　　　(j) 2 cm = _____ mm

3. **Match the columns:**

Column A		Column A	
(a) 24 m 35 cm =		(i) 5 km 5 m	
(b) 24 kg 35 g =		(ii) 18 km 15 m	
(c) 18015 m =		(iii) 10 m 51 cm	
(d) 1051 cm =		(iv) 2435 g	
(e) 5005 m =		(v) 2435 cm	

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Custom Learning Path

4. A watermelon weight 2448 g and another watermelon weight 3309 g. Estimate the sum of the weights of the two watermelons in terms of the nearest hundred.

5. The distance between two places A and B is 2095 km and the distance between two places A and C is 1505 km. Estimate the difference between the two distances in terms of the nearest hundred.

6. 540 litres of water is stored in a tank. If 130 litres 850 m*l* water is consumed during the day, how much water is left in the tank after the consumption?

Puzzle

Measurements word search

P	I	P	R	A	I	C	K
H	G	M	O	R	A	K	I
H	P	E	G	U	R	N	L
L	I	T	R	E	G	O	O
A	N	R	A	G	L	I	G
M	A	E	M	A	K	A	R
N	S	U	R	N	A	D	A
B	A	D	I	G	R	O	M

1. Weight measured in _____.

2. Capacity is measured in _____.

3. Length is measured in _____.

4. Lower unit of weight is _____.

Maths Lab Activity

Objective : To know the units of different weight

Material required

✦ A sheet with pictures of different sized jars, each denoting a different weight, (1000 g, 500 g, 200 g, 100 g, 50 g, 20 g, 10 g and 5 g) for each student.

✦ A pair of scissors

Procedure :

Divide the students into groups. Ask each student to cut out all the jars separately and keep with him/her. You call out a certain weight, say 2 kg and 670 g. Each group must pool in their jars and try to give you jars equivalent to the weight you asked. Repeat different combinations of weights and each time the group must see how they can give you the weights for the sum presented by you. Discuss the differences between the groups so that the children understand that the same total can be achieved with different combinations.

For example,

2 kg can be given as four 500 g or as one 1 kg and two 500 g, or as two 1 kg and so on.