9 Measurements

Measurement of Length, Mass and Capacity

You are already familiar about the standard units of length, mass and capacity. Now, you will learn a little more about these units and their conversion.

Basically, we use the metric units for measuring length, mass and capacity. These are international units.

The system of measurement of length, mass (weight) and capacity is known as metric system which is based on decimal system. Length is generally measured in metres and centimetres, mass is measured in kilograms and grams while capacity is measured in litres and millilitres.

The following table shows the measures of length :

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Kilometre	Hectometre	Decametre	Metre	Decimetre	Centimetre	Millimetre

The basic unit of measure of length is metre. There are lower and higher units of measure of length.

The various units of measure have the following relationships :

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

It is also written as : 1 kilometre = 1000 metres
1 metre = 100 centimetres

1 decimetre = $\frac{1}{10}$ metre, 1 centimetre = $\frac{1}{100}$ metre, 1 millimetre = $\frac{1}{1000}$ metre

The following table shows the measures of mass (weight) :

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Kilogram	Hectogram	Decagram	Gram	Decigram	Centigram	Milligram

The basic unit of measure of mass (weight) is gram. The various units of measure of mass or weight have the following relationships :

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

It is also written as :
1 kilogram = 1000 grams
1 gram = 100 centigrams
1 decigram = $\frac{1}{10}$ gram
1 centigram = $\frac{1}{100}$ gram
1 milligram = $\frac{1}{1000}$ gram

The following table shows the measure of capacity :

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Kilolitre	Hectolitre	Decalitre	Litre	Decilitre	Centilitre	Millilitre

The basic unit of measure of capacity is litre. The various units of measure of capacity have the following relationships :

1 kilolitre ($k\ell$) = 10 hectolitres ($h\ell$)
1 hectolitre ($h\ell$) = 10 decalitres ($da\ell$)
1 decalitre ($da\ell$) = 10 litres (ℓ)

1 litre (ℓ) = 10 decilitres ($d\ell$)
1 decilitre ($d\ell$) = 10 centilitres ($c\ell$)
1 centilitre ($c\ell$) = 10 millilitres ($m\ell$)

It is also written as : 1 kilolitre = 1000 litres, 1 litre = 100 centilitres

1 decilitre = $\frac{1}{10}$ litre, 1 centilitre = $\frac{1}{100}$ litre, 1 millilitre = $\frac{1}{1000}$ litre

The relationships among the various units of measures of length, mass or weight and capacity can also be expressed in the form of combined place value table.

Facts to Know

- **Measurement-measure unit likes, Kilometer, Hectometer, Decameter, Meter, Decimeter, Centimeter, Millimeter.**

The following table shows the combined place value table :

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousands
1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Kilometre or Kilogram or Kilolitre	Hectometre or Hectogram or Hectolitre	Decametre or Decagram or Decalitre	Metre or Gram or Litre	Decimetre or Decigram or Decilitre	Centimetre or Centigram or Centilitre	Millimetre or Milligram or Millilitre

Converting one unit of measure into another by using a few rules.

Rule 1 : For converting a higher unit into lower unit, we multiply the higher unit by 10 or 100 or 1000... as the case may be.

Rule 2 : For converting a lower unit into higher unit, we divide the lower unit by 10 or 100 or 1000... as the case may be.

Example I : Convert the following.

a. 5 kg into g b. 6.452 km into km and m

Solution : a. 5 kg into g

Since, 1 kg = 1000 g

Therefore, 5 kg = 5 × 1000 g = 5000 g

b. 6.452 km into km and m

6.452 km = 6 km + 0.452 km

= 6 km + 0.452 × 1000 m

= 6 km + 452 m = 6 km 452 m

Example II : Convert the following as directed.

a. 3 hm into dam b. 1.7 dam into cm

Solution : a. 3 hm into dam

Since, 1 hm = 10 dam.

Therefore, 3 hm = 3 × 10 dam = 30 dam.

b. 1.7 dam into cm

Since, 1 dam = 1000 cm.

Therefore, 1.7 dam = 1.7 × 1000 cm = 1700 cm.

Example III : Convert the following as directed

a. 5000 ℓ into $k\ell$ b. 3000 mm into m

Solution : a. 5000 ℓ into $k\ell$

Since, 1000 ℓ = 1 kl and $1\ell = \frac{1}{1000} k\ell$

Therefore, 5000 ℓ $= 5000 \times \frac{1}{1000} k\ell = 5\, k\ell$

b. 3000 mm into m

Since, 1000 mm = 1 m and $1 \text{ mm} = \frac{1}{1000}$ m

Therefore, 3000 mm $= 3000 \times \frac{1}{1000} \text{m} = 3 \text{ m}$

Exercise 9.1

1. Convert the following as directed.

a. 3 km into m b. 6 kg into g c. 2 ℓ into $m\ell$ d. 5.565 km into m

2. Convert the following into km.

a. 6500 dam b. 6400 m c. 5500 m d. 6000 hm

3. Convert the following into kg.

a. 13000 g b. 875 g c. 160 dag d. 46000 dg

4. Convert the following into kl.

a. 4350 ℓ b. 8005 ℓ c. 37850 $d\ell$ d. 3230 $h\ell$ e. 557 $da\ell$

Addition and Subtraction of Measures

Addition and subtraction of different measures is done in the same way as addition and subtraction of whole numbers. We add or subtract similar measure like gram with gram and kg with kg. The carrying and borrowing processes are also similar to that of whole numbers.

Example IV : Add 12 km 510 m and 8 km 410 m.

Solution : We have,

	①		
	12 km	510 m	
+	8 km	410 m	
	20 km	920 m	

Example V : Subtract 4 ℓ 635 mℓ from 8 ℓ.

Solution : We have,

	⑦	⑨ ⑨ ⑩	
	8 ℓ	1 ~~0~~ ~~0~~ ~~0~~ mℓ	
–	4 ℓ	6 3 5 mℓ	
	3 ℓ	3 6 5 mℓ	(since, 8 ℓ = 7 ℓ 1000 mℓ)

Exercise 9.2

1. Add the following.

a. 21 km 475 m and 7 km 275 m

b. 18 kg 620 g and 350 g

c. 6 ℓ 240 mℓ, 12 ℓ 500 mℓ and 520 mℓ

d. 21g 500 mg, 8 g 250 mg and 1 g 150 mg

2. Subtract the following.

a. 7 kg 550 g from 12 kg 250 g

b. 7 kℓ 264 ℓ from 13 kℓ 472 ℓ

c. 17 kg 300 g from 21 kg 235 g

d. 6 km 425 m from 11 km 300 m

3. Sandra bought 3 kg 500 g of tomatoes, 2 kg 750 g of cabbage and 4 kg 150 g of cucumber . Find the total weight of vegetables she purchased?

4. Simi travelled 15 km 250 m by bus, 4 km 525 m by auto-rickshaw and 2 km 375 m on foot. Calculate the total distance she travelled?

5. If four tanks contain 1972.20 ℓ, 1536.35 ℓ, 896.25 ℓ and 2450 ℓ of petrol respectively. Find the total quantity of petrol in four tanks.

6. Jaya walks 35 m 50 cm towards west and 75 m 75 cm towards south to reach his friends home. Find the total distance she walked.

7. Sister bought 5 ℓ 250 $m\ell$ of packed juice. She used 2 ℓ 250 $m\ell$ consumed at home. What quantity of juice was left?

Multiplication and Division in Metric Measures

Just as addition and subtraction of quantities, we can also multiply and divide number by conversion of units.

Example VI : Convert into grams and multiply.

5 kg 4 dag 3 dg by 2.1

Solution : Let us convert into grams.

= kg hg dag g dg

= 5 0 4 0 3

= 5040.3 g

Now, let us multiply as usual.

5040.3 decimal after 1 place

× 2.1 decimal after 1 place

5040 3

+1008060

10584.63 (decimal after 1 + 1 = 2 places)

Example VII : Divide 172 km 8 m by 6.

Solution : 172 km 8 m = 172.008 km

Now, divide 172.008 ÷ 6.

Here, Q = 28.668 and R = 0.

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   28.668
6 ) 172.008 (
  - 12
    52
  - 48
     40
   - 36
      40
    - 36
       48
     - 48
        0
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Exercise 9.3

1. **Find the product.**
   a. 6 km 5 hm 3 dam 4 m by 12
   b. 25 m 15 cm by 9
   c. 62 kg 175 g by 15
   d. 7 *kl* 546 *l* by 8
2. **Divide.**
   a. 9 km 6 hm 8 dam 0 m by 16 (Convert in hm)
   b. 2 km 1 hm 5 dam 4 dm by 56 (Convert in dam)
   c. 2 km 2 hm 3 dam 2 m 9 dm 0 cm by 135 (Convert in m)
   d. 3 km 1 hm 4 m 6 dm 4 cm by 63 (Convert in km)
3. The cost of 11 kg of coconut is ₹ 228.25. Find the cost of 1 kg of coconut.
4. Length of one ribbon is 17.35 cm. Find the length of 5 such ribbons.
5. The weight of 8 bags is 517.2 kg. Find the weight of one such bag.
6. A jar contains 5.45 ℓ of juice. How much juice will be contained in 18 such jars?
7. A car travels 748.8 km in 12 hours. How much distance will be travelled in one hour?
8. One shirt requires 1 m 7 dm 5 cm of cloth. How much cloth is required to make 12 such shirts?
9. 1 drum contains 9 ℓ 3 $d\ell$ 5 $m\ell$ of water. How much will be contained in 17 such drums?
10. Sodhi gimnast requires 2 ℓ 125 $m\ell$ of butter milk every day. How much butter milk did he has consumed in January 2006?

Points to Remember

- We use metric units for measuring length, mass and capacity. These are International units.
- Metric system is the system of measurement of length, mass and capacity. This system is based on decimal system.
- The basic units of measure of length, mass and capacity are metre, gram and litre respectively.
- Addition and Subtraction of different measures is done in the same way as addition and subtraction of whole numbers.
- We can also multiply and divide the numbers by conversion of units.

EXERCISE

1. Multiple Choice Questions (MCQs)

Tick (✓) the correct option:

a. How many decametres (dam) are there in 10 hectometres (hm)?

(i) 100 dam ☐ (ii) 1000 dam ☐ (iii) 500 dam ☐ (iv) 0.005 dam ☐

b. How many centigrams (cg) will make 10 decigrams (dg)?

(i) 50 cg ☐ (ii) 100 cg ☐ (iii) 500 cg ☐ (iv) 1000 cg ☐

c. How many metres (m) are there in 62.8 km?

(i) 26800 m ☐ (ii) 82600 m ☐ (iii) 62800 m ☐ (iv) 82800 m ☐

d. Which one of the following is the sum of 28 km 750 m 15 km 510 m and 17 km 625 m?

(i) 76 km 312 m ☐ (ii) 229 km 500 m ☐

(iii) 61 km 885 m ☐ (iv) 99 km 315 m ☐

e. How much will we get on subtracting 188 kg 470 g from 200 kg?

(i) 34 kg 680 g ☐ (ii) 45 kg 360 g ☐

(iii) 11 kg 530 g ☐ (iv) 132 kg 75 g ☐

2. Convert the following as directed.

a. 7 km into m b. 7.655 m into mm c. 2.750 g into mg

d. 4 *kℓ* into *dℓ* e. 6000 mm into cm f. 4000 cg into dag

3. A can of 18 litres of oil was purchased for a function. After the function, 9 *ℓ* 350 *mℓ* of oil was left in the can. How much oil was consumed in the function?

4. A tailor has 12 m 40 cm of cloth with him. He used 4 m 75 cm to make shirts. How much cloth was left?

5. During morning walk, Soha walked 2 km 250 m and Aruna walked 3 km 250 m. Who walked more and by how much?

6. The weight of Nancy is 45 kg 250 g and the weight of Princy is 38 kg 725 g. Find the difference of their weights. What is their total weight?

7. 1 drum contains 9 *ℓ* 3 *dℓ* 5 *mℓ* of water. How much water will be contained in 17 such drums?

HOTS

Soniya requires 1 ℓ 850 ml of milk everyday. How much milk did she has consumed in February 2013?

Lab Activity

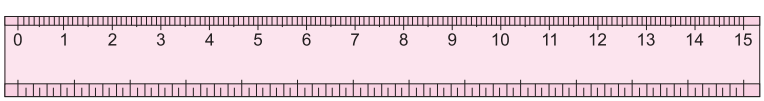
Objective : To understand the measure of length, mass and capacity.

Materials Required :Worksheet to record measurement, gram scales, weights, ruler, metre sticks and graduated containers

Activities :

- Weigh the fruits with a gram scale.

- Now, convert the following :
  a. 530 mg to g b. sum of 25 kg and 30 kg into g
- Measure the length of table, blackboard and notebook.



- Convert the following:
  a. 8000 m into km b. 705 mm into cm
- Measure 50 ml water with a container and convert it into litres.