Measurement

Metric System

The metric system uses the 'base ten place value system'. It means if we want to convert from one metric measure to another, then we just multiply or divide it by 10 or any power of ten. In this system, different units of length, weight, time, measurement etc., are generally connected to decimal relation.

Units in Metric System

International name of main units of metric system are as follow

- Length = 1 metre (m)
- Weight = 1 gram (gm)
- Time = 1 second (sec)
- Area = 1 cm^2 or 1 m^2
- Volume = 1 cm^3 or 1 m^3

Measurement of Length

Measurement of length is usually defined as the size of the object, its length, breadth or height. Terms like long, short, wide, deep, near, far etc., are described as measurement of length. Even distance comes under this category.

Measures of Length in Metric System

- 1 kilometre (km) = 10 hectometre (hm)
- 1 hectometre (hm) = 10 decametre (Dm)
- 1 decametre (Dm) = 10 metre (m)

- 1 metre (m) = 10 decimetre (dm)
- 1 decimetre (dm) = 10 centimetre (cm)
- 1 centimetre (cm) = 10 millimetre (mm)

Example 1 Convert $\dfrac{3}{5}$ m into centimetre.

(a) 6 cm   (b) 60 cm
(c) 50 cm   (d) 600 cm

Sol. *(b)* ∵ 1 m = 100 cm

∴ $\dfrac{3}{5}$ m = $\dfrac{3}{5} \times 100$ cm = 60 cm

Measurement of Weight

Weight is measured to find out how much an object is heavy or light as compared to another object.

e.g. A boy is heavier than a pen. The commonly used units of weight are kilogram, gram, quintal, tonne etc.

Measures of Quantity in Metric System

- 1 metric tonne = 10 quintal
- 1 quintal = 100 kilogram (kg)
- 1 kilogram (kg) = 10 hectogram (hg)
- 1 hectogram (hg) = 10 decagram (Dg)
- 1 decagram (Dg) = 10 gram (gm)
- 1 gram (gm) = 10 decigram (dg)
- 1 decigram (dg) = 10 centigram (cg)
- 1 centigram (cg) = 10 milligram (mg)

Example 2 Convert 3 gm 2 dg 5 cg in mg.

    (a) 3570 mg   (b) 3100 mg
    (c) 3250 mg   (d) 3450 mg

Sol. *(c)* $\because$ 3 gm $= 3 \times 1000$ mg $= 3000$ mg

$$2 \text{ dg} = 2 \times 100 \text{ mg} = 200 \text{ mg}$$
$$5 \text{ cg} = 5 \times 10 \text{ mg} = 50 \text{ mg}$$

$\therefore$ 3 gm 2 dg 5 cg $= (3000 + 200 + 50)$ mg
$$= 3250 \text{ mg}$$

Measures of Liquid Substance in Metric System

- 1 kilolitre (kL) = 10 hectolitre (hL)
- 1 hectolitre (hL) = 10 decalitre (DL)
- 1 decalitre (DL) = 10 litre (L)
- 1 litre (L) = 10 decilitre (dL)
- 1 decilitre (dL) = 10 centilitre (cL)
- 1 centilitre (cL) = 10 millilitre (mL)

Conversion from Capacity into Volume	
1 litre (L)	1000 cubic centimetres (cm^3)
1 litre (L)	1/1000 cubic metre (m^3)
1 litre (L)	1 cubic decimetre (dm^3)

Example 3 Convert 4 L into centilitres.

    (a) 400 cL   (b) 2000 cL
    (c) 100 cL   (d) 40 cL

Sol. *(a)* $\because$ 1 L $= 100$ mL
$\therefore$ 4 L $= 100 \times 4$ cL
$$= 400 \text{ cL}$$

Measurement of Time

We do our daily work in different intervals of time.

We can measure the time period in minute, hour etc.

Larger units of time are day, week, month and year etc. We can measure the time by clock device, with which time period of seconds to hours can be measured.

Units of Time

The smallest unit of time is second, which is 1/60th part of 1 minute.

i.e.   1 minute (min) = 60 seconds (s)

And 1 hour (h) = 60 minute (min)

Measures of Time

- 60 s = 1 min
- 60 min = 1 h
- 24 h = 1 day
- 7 days = 1 week
- 30 / 31 days = 1 month
- 365 days = 1 yr
- 366 days = 1 leap yr
- 12 months = 1 yr
- 100 yr = 1 centuary

Example 4 Which of the following part is 1 s of 1 h?

    (a) 0.00028 h   (b) 0.0827 h
    (c) 0.0027 h   (d) 0.0072 h

Sol. *(a)* $1 \text{ s} = \dfrac{1}{60} \text{ min} = \dfrac{1}{60 \times 60} \text{ h}$

$$= \dfrac{1}{3600} \text{ h} = 0.00028 \text{ h (approx.)}$$

Measurement of Area

The amount of surface enclosed by a closed figure is called its area and units of area are measured in coefficient of square units.

Measures of Area in Metric System

1 sq cm	=	100 sq mm
1 sq dm	=	100 sq cm
1 sq m	=	100 sq dm
1 sq Dm	=	100 sq m
1 sq hm	=	100 sq Dm
1 sq km	=	100 sq hm

☑ For units of area, we take powers of 10^2 instead of 10.

Example 5 What is the area of a rectangle whose breadth is 5 m and its length is double to its breadth?

    (a) 50000 cm^2 (b) 50 cm^2
    (c) 30000 cm^2 (d) 500000 cm^2

Sol. *(d)* $\because$ Breadth of rectangle $= 5$ m

Now, length (double the breadth) $= 2 \times 5 = 10$ m
$\therefore$ Area of rectangle $=$ Length $\times$ Breadth
$$= 10 \times 5 = 50 \ m^2$$
$$= 500000 \text{ cm}^2 \ (\because 1 \ m^2 = 10000 \ cm^2)$$

Measurement of Volume

Volume is a measure of 3-dimensional space. The space occupied by closed 3-dimensional objects such as a box, note-book, a cane (with a lid), a cupboard, a brick, a stone etc., is their volume.

Suppose in a drum, 250 L oil is there and it is fully filled. Then, we can say that volume of oil in a drum is 250 L or we can say that the capacity of drum is 250 L.

Measures of Volume in Metric System

Relations between different measures of volume in metric system are as follow

Unit and Coefficient of Volume

Units	Signs	Coefficients
Cubic cm	$1\ cm^3$	$1000\ mm^3$
Cubic dm	$1\ dm^3$	$1000\ cm^3$
Cubic m	$1\ m^3$	$1000\ dm^3$
Litre	$1\ L = 1\ dm^3$	$1000\ cm^3$
Cubic inch	$1\ inch^3$	$16387\ mm^3$
Cubic feet	$1\ feet^3$	$28317\ cm^3$
Gallon	1 gallon	3.78 L
Cubic cm	$1\ cm^3$	$0.00001\ m^3$
Cubic dm	$1\ dm^3$	$0.001\ m^3$

Example 6 What is the volume of a box whose length is 300 cm, breadth is 200 cm and height is 200 cm?
(a) $15\ m^3$ (b) $14\ m^3$
(c) $12\ m^3$ (d) $15\ m^3$

Sol. *(c)* Volume of the box
$$= Length \times Breadth \times Height$$
$$= 300 \times 200 \times 200 = 12000000\ cm^3$$
$$= 12\ m^3$$

Indian Currency

Indian rupee is the official currency of the republic of India.
- The modern rupee is subdivided into 100 paise and the symbol of Indian rupee is '₹'.
- To convert rupees into paise, we multiply by 100 and to convert paise into rupees, we divide by 100.

Example 7 Convert ₹ 25 into paise.
(a) 2450 paise   (b) 2300 paise
(c) 2500 paise   (d) 2400 paise

Sol. *(c)* ₹ 25 = 25 ×100 paise = 2500 paise

Conversion of Celsius and Fahrenheit Temperature

- Conversion from centigrade scale to fahrenheit scale
$$F = \frac{9}{5}C + 32$$

- Conversion from fahrenheit scale to centigrade scale
$$C = \frac{5}{9}(F - 32)$$

Example 8 The value of 302°F in degree celsius is ..... .
(a) 150°   (b) 120°
(c) 165°   (d) 151°

Sol. *(a)* From formula,
$$C = \frac{5}{9}(F - 32)$$
$$= \frac{5}{9}(302 - 32) = \frac{5}{9} \times 270 = 150\,°C$$

⏰ Practice Exercise

1. 107 cm is equivalent to
(a) 10.7 m   (b) 1.07 m
(c) 0.107 m   (d) 1070 m

2. 1 km is equivalent to
(a) 1000 mm   (b) 100000 mm
(c) 10000 mm   (d) 1000000 mm

3. If a bag weighs 0.78 kg, then find the weight of bag in gram.
(a) 780 gm   (b) 777 gm
(c) 781 gm   (d) 790 gm

4. 4 L is equal to
(a) 4000 mL   (b) 400 mL
(c) 40000 mL   (d) 400000 mL

5. The weight of a basket is 3 kg 550 gm. What is its weight in gram?
(a) 3549 gm   (b) 3550 gm
(c) 3556 gm   (d) 3554 gm

6. What time is 3 h 40 min before 2 : 30 pm?
(a) 11 : 00 am   (b) 10 : 50 am
(c) 11 : 30 am   (d) 11 : 55 am

7. The number of hours and minutes from 6 : 19 am to 8 : 19 pm on same day is
(a) 14 h   (b) 12 h   (c) 11 h   (d) 13 h

8. If an apple costs ₹ 8, then how much will two and a half dozen apples cost?
(a) ₹ 120   (b) ₹ 230   (c) ₹ 240   (d) ₹ 235

9. 250 mL juice is filled in one bottle and eight such bottles are packed in one carton. The number of cartons needed for 2000 L of juice is
(a) 7500   (b) 1000   (c) 8500   (d) 9000

10. Rahul bought 2 kg 500 gm apples from market. If he gives 1 kg 250 gm apples to his sister, how much is he left with?
(a) 1250 gm   (b) 12500 mg
(c) 12500 mg   (d) 12500 gm

11. Sushmita has ₹ 250.00. Her mother gave her ₹ 325.00 more but she has to give ₹ 200.50 to her younger sister. Also, she purchased three registers of ₹ 20.20 each. Now, what amount of money does she have?
(a) ₹ 3000.90   (b) ₹ 313.90
(c) ₹ 327.20   (d) None of these

12. The number of seconds in 5 h equals to the number of minutes in
(a) 11 days   (b) $11\frac{1}{2}$ days

(c) 12 days   (d) $12\frac{1}{2}$ days

13. A train leaves station A at 9 : 20 am and reaches the station B at 1 : 30 pm. The time taken by the train is
(a) 4 h 10 min   (b) 4 h 35 min
(c) 3 h 59 min   (d) 4 h 30 min

14. $\frac{14}{5}$ of an ordinary year = ... week.
(a) 146   (b) 41   (c) 90   (d) 77

15. The value of 212° F in degree celsius is .... .
(a) 100°C   (b) 105°C   (c) 200°C   (d) 95°C

Answers

1	(b)	2	(d)	3	(a)	4	(a)	5	(b)	6	(b)	7	(a)	8	(c)	9	(b)	10	(a)
11	(b)	12	(d)	13	(a)	14	(a)	15	(a)										

Hints & Solutions

1. ∵   1 m = 100 cm

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

∴ $107 \text{ cm} = \frac{107}{100} \text{ m} = 1.07 \text{ m}$

2. ∵   1 km = 1000 m
        1 m = 1000 mm
∴   1 km = 1000 × 1000 = 1000000 mm

3. ∵   1 kg = 1000 gm
∴ 0.78 kg = 1000 × 0.78 gm = 780 gm

4. ∵ 1 L = 1000 mL
∴ 4 L = 4 × 1000 = 4000 mL

5. ∵   1 kg = 1000 gm
Now, 3 kg = (3 × 1000) gm = 3000 gm
∴ 3 kg 550 gm = (3000) + 550 = 3550 gm

6. ∴ Required time = 2 : 30 pm − 3 h 40 min
                   = 10 : 50 am

7. ∵ Total hours from 6 : 19 am to 6 : 19 pm = 12 h
and total hours from 6 : 19 pm to 8 : 19 pm = 2 h
∴ Total hours = (12 + 2) h = 14 h

8. Total apples = $2\frac{1}{2}$ dozen = $\frac{5}{2} \times 12$ = 30 apples

∴   Total cost = ₹ (30 × 8) = ₹ 240

9. ∵ 250 mL juice is filled in 1 bottle.

∴ 1 mL juice is filled in $\frac{1}{250}$ bottle.

∴ 1000 mL juice is filled in $\frac{1}{250} \times 1000$,

i.e. 4 bottles.
Now, 2000 L juice is filled in 4 × 2000,
i.e. 8000 bottles.

∴ Number of cartons needed = $\frac{8000}{8}$ = 1000

10. Remaining weight of apples
        = (2 kg 500 gm − 1 kg 250 gm)
        = 1 kg 250 gm = 1250 gm

11. The amount of money which Sushmita has
= ₹ 250.00 After taking money from her mother,
she has = 250.00 + 325.00 = ₹ 575.00

After giving her sister, she has = 575.00 − 200.50
= ₹ 374.50

After changing the registers, she has
= 374.50 − 20.20 × 3 = ₹ 313.90

12. Number of seconds = $5 \times 60 \times 60 = 18000$ s

Let 18000 s in x days.

Then, $x \times 24 \times 60 = 18000$

∴ $x = \dfrac{18000}{24 \times 60} = 12\dfrac{1}{2}$ days

13. Number of hours from 9 : 20 am to 12 noon
= 2 h 40 min

Number of hours from 12 : 00 noon to 1 : 30 pm
= 1 h 30 min

∴ Total time taken = 2 h 40 min + 1 h 30 min
= 4 h 10 min

14. ∵ Total days in an ordinaly year = 365

∴ Total week = $\dfrac{14}{5} \times \dfrac{365}{7}$ [∵ 1 week = 7 days]

= $2 \times 73 = 146$

15. ∵ $C = \dfrac{5}{9}(F - 32)$

= $\dfrac{5}{9}(212 - 32)$

= $\dfrac{5}{9} \times 180 = 5 \times 20 = 100°C$

➜ Try Yourself

1) The weight of some mangoes is 2 kg 600 gm and that of some apples is 1 kg 450 gm. The weight of the mangoes is greater than that of the apples by
(a) 1 kg 200 gm   (b) 150 gm
(c) 4 kg 50 gm   (d) 1 kg 150 gm

2) Look at the following table

Station		Bus 1	Bus 2	Bus 3
New Delhi	Departure	19 : 15	12 : 30	16 : 45
Faridabad	Arrival	20 : 22	13 : 25	19 : 10
	Departure	20 : 37	13 : 35	19 : 22
Mathura	Arrival	00 : 40	18 : 10	21 : 55

Which bus takes the least time to reach Mathura from New Delhi?
(a) Bus 3
(b) Both buses 2 and 3 take equal time
(c) Bus 1
(d) Bus 2

3) What time is 4 h 59 min before 2 : 58 pm?
(a) 9 : 59 am   (b) 10 : 01 am
(c) 9 : 59 pm   (d) 9 : 57 am

4) A pencil costs two and a half rupees. Amit buys one and a half dozen pencils and gives a ₹ 100 note to the shopkeeper. The money he will get back is
(a) ₹ 45   (b) ₹ 65
(c) ₹ 30   (d) ₹ 55

5) Floor of a square room of side 10 m is to be completely covered with square tiles, each having length 50 cm. The number of tiles needed is
(a) 200   (b) 300   (c) 400   (d) 500

6) Internal length, breadth and height of a rectangular box are 10 cm, 8 cm and 6 cm respectively. How many boxes are needed to pack 6240 cm³ cubes?
(a) 12   (b) 13
(c) 15   (d) 17

7) Which one of the following is not correct?
(a) 1 paisa = ₹ 0.01
(b) one and a half dozen = 18
(c) 1 mm = 0.1 cm
(d) 3 L 30 mL = 330 mL

8) The value of 185°C in degree fahrenheit is ..... .
(a) 365°   (b) 360°
(c) 270°   (d) 400°

9) $\dfrac{7}{6}$ of a leap year = ... week.
(a) 427   (b) 35   (c) 61   (d) 13

10) Which one of the following is not correct?
(a) 0.10 is same as 0.1   (b) 56.7 kg = 5670 gm
(c) A cube has six faces   (d) 1 mm = 0.1 cm

Answers

1	*(d)*	2	*(a)*	3	*(a)*	4	*(d)*	5	*(c)*
6	*(b)*	7	*(d)*	8	*(a)*	9	*(c)*	10	*(b)*