9

Mass

By studying this lesson, you will be able to,

- identify metric ton as a unit used to measure mass,
- know the relationship between kilogramme and metric ton.
- solve problems associated with mass which include metric tons.

9.1 Units used to measure mass

You have learnt before that milligramme, gramme and kilogramme are units used to measure mass. Now let us identify another unit used to measure mass.

It is mentioned that the mass of the paracetamol in a paracetamol tablet shown in the figure is 500 mg.

It is mentioned that the mass of the margarine in the packet of margarine shown in the figure is 250 g.

It is mentioned that the mass of the cement in the bag of cement shown in the figure is 50 kg.

The approximate mass of the lorry loaded with goods shown in the figure is mentioned as 20 t.

According to the information given above, in order to measure a heavy mass like a lorry, the unit metric ton is used, which is larger than the unit kilogramme (kg). The letter t is used to indicate "metric ton".

One metric ton is equal to a thousand kilogrammes. Accordingly, 1 t = 1000 kg

The relationship between the above mentioned units used to measure mass is given below.

1 g = 1000 mg
1 kg = 1000 g
1 t = 1000 kg

9.2 The relationship between kilogramme and metric ton

• Expressing a mass given in metric tons in kilogrammes

Now let us see how to express a mass given in metric tons in kilogrammes.

Since 1 t = 1000 kg

2 t = 2 × 1000 kg = 2000 kg

3 t = 3 × 1000 kg = 3000 kg

Accordingly, in order to express a mass given in metric tons in kilogrammes, the amount given in metric tons should be multiplied by 1000.

Example 1

Express 8.756 t in kilogrammes.

8.756 t = 8.756 × 1000 kg
= 8756 kg

Example 2

Express 3 t 850 kg in kilogrammes.

3 t 850 kg = 3 t + 850 kg
= 3 × 1000 kg + 850 kg
= 3000 kg + 850 kg
= 3850 kg

Example 3

Express 8.756 t in metric tons and kilogrammes.

8.756 t = 8 t + 0.756 t
= 8 t + 0.756 × 1000 kg
= 8 t + 756 kg
= 8 t 756 kg

Example 4

Express $3\frac{1}{2}$ t in kilogrammes.

$3\frac{1}{2}$ t = 3 t + $\frac{1}{2}$ t
= 3 × 1000 kg + 500 kg
= 3000 kg + 500 kg
= 3500 kg

• Expressing a mass given in kilogrammes in metric tons

Next let us see how to express a mass given in kilogrammes in metric tons.

Since 1000 kg = 1 t

2000 kg = $\frac{2000}{1000}$ t = 2 t

3000 kg = $\frac{3000}{1000}$ t = 3 t

Accordingly, in order to express a mass given in kilogrammes in metric tons, the amount given in kilogrammes should be divided by 1000.

Example 5

Express 2758 kg in metric tons.

$2758 \text{ kg} = \frac{2758}{1000} \text{ t}$

$= 2.758 \text{ t}$

Example 6

Express 2225 kg in metric tons and kilogrammes.

$2225 \text{ kg} = 2000 \text{ kg} + 225 \text{ kg}$

$= \frac{2000}{1000} \text{ t} + 225 \text{ kg}$

$= 2 \text{ t} + 225 \text{ kg}$

$= 2 \text{ t } 225 \text{ kg}$

When expressing a mass of 1000 kg or more in kilogrammes and metric tons, the number of kilogrammes is written as an addition of a multiple of 1000 and a number less than 1000.

Example 7

Express 3 t 675 kg in metric tons.

$3 \text{ t } 675 \text{ kg} = 3 \text{ t} + 675 \text{ kg}$

$= 3 \text{ t} + \frac{675}{1000} \text{ t}$

$= 3 \text{ t} + 0.675 \text{ t}$

$= 3.675 \text{ t}$

Example 8

Complete the table given below.

Mass	The mass in t and kg	The mass in metric tons
2400 kg	2 t 400 kg	2. 400 t
5850 kg	5 t 850 kg	5. 850 t
1050 kg	1 t 050 kg	1. 050 t
600 kg	0 t 600 kg	0. 600 t

Exercise 9.1

(1) Express the masses given below in metric tons.

(i) 2350 kg (ii) 5050 kg (iii) 3 t 875 kg (iv) 13 t 7 kg

(2) Express each mass given below in kilogrammes.

(i) 7 t (ii) 17 t (iii) 3 t 650 kg (iv) 2 t 65 kg

(v) 1.075 t (vi) 7.005 t (vii) 4.68 t (viii) $\frac{3}{4}$ t

(3) Express each mass given below in metric tons and kilogrammes.
(i) 1.275 t (ii) 2.025 t (iii) 5.75 t (iv) 7.3 t (v) 7.003 t

(4) The mass of a fully grown whale is approximately 19 000 kg. Express this mass in metric tons.

(5) Place a ✓in front of the unit that is used to measure the mass of each item given below.

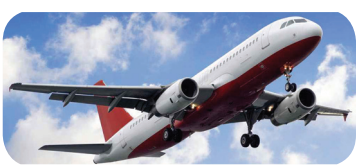
	The item to be measured	mg	g	kg and g	kg	t
(i)	A mango	.....	.....	.....	.....	.....
(ii)	A comb of plantains	.....	.....	.....	.....	.....
(iii)	A bag of sweet potatoes	.....	.....	.....	.....	.....
(iv)	A loaf of bread	.....	.....	.....	.....	.....
(v)	A lorry	.....	.....	.....	.....	.....
(vi)	Ten travelling bags in a lift	.....	.....	.....	.....	.....

(6) Complete the table given below.

The mass of the given item in metric tons	That mass in metric tons and kilogrammes	That mass in kilogrammes
1.6 t	1 t 600 kg	1600 kg
3.85 t	.....	.....
7.005 t	.....	.....
.....	7 t 875 kg	.....
.....	6 t 5 kg	.....
.....	.....	7008 kg
.....	.....	14 375 kg

9.3 Addition of two masses expressed in metric tons and kilogrammes

The total mass of the passengers and travelling bags in an air plane of mass 181 t 350 kg is 60 t 800 kg. Let us find the mass of the air plane with the passengers and travelling bags.



To do this, let us add the masses of the air plane, passengers and travelling bags.

Method 1

	t	kg
	181	350
+	60	800
	242	150

Let us add the quantities in the kilogrammes column.

350 kg + 800 kg = 1150 kg

1150 kg = 1000 kg + 150 kg

= 1 t + 150 kg

Let us write 150 kg in the kilogrammes column.

Let us carry 1 t to the metric tons column and add the quantities in this column.

1 t + 181 t + 60 t = 242 t

Let us write 242 t in the metric tons column.

Therefore, the total mass is 242 t 150 kg.

Method II

Let us express each mass in metric tons and then simplify.

181 t 350 kg = 181.350 t

60 t 800 kg = 60.8 t

181.350 t + 60.800 t = 242.150 t

242.150 t = 242 t + 150 kg

	t
	181 . 350
+	60 . 800
	242 . 150

Therefore, the total mass is 242 t 150 kg.

Method III

Let us express each mass in kilogrammes and simplify.

181 t 350 kg = 181 350 kg

60 t 800 kg = 60 800 kg

181 350 kg + 60 800 kg = 242 150 kg

242 150 kg = 242 t 150 kg

Therefore, the total mass is 242 t 150 kg.

Example 1

Add 10 t 675 kg and 3 t 40 kg.

	t	kg
	10	675
+	3	040
	13	715

Exercise 9.2

(1) Express the answer in metric tons and kilogrammes.

(i)

	t	kg
	2	780
+	1	620

(ii)

	t	kg
	3	450
	6	065
+	1	275

(iii) 10 t 225 kg + 6 t 705 kg

(iv) 150 t 650 kg + 40 t 460 kg

(2) The mass of a grown elephant is 4.75 t. The mass of a baby elephant is 2025 kg.

(i) Express the mass of the baby elephant in metric tons.
(ii) Find the total mass of both elephants in metric tons.
(iii) Express the total mass of both elephants in kilogrammes.

(3) A lorry of mass 3 t 450 kg is loaded with 2 t 700 kg of sugar and 4 t of rice. Find the total mass of the lorry with the goods loaded in it.

9.4 Subtraction of masses expressed in kilogrammes and metric tons

The total mass of a lorry loaded with rice is 10 t 250 kg. The mass of the lorry is 3 t 750 kg. Let us find the mass of the rice loaded in the lorry.

In order to find the mass of the rice loaded in the lorry, the mass of the lorry should be subtracted from the total mass.

Method I

	t	kg
	10	250
−	3	750
	6	500

Since 750 kg cannot be subtracted from 250 kg, let us carry 1 t from the 10 t in the metric tons column, that is, 1000 kg, to the kilogrammes column and add it to the 250 kg in the kilogrammes column.
Then, 1000 kg + 250 kg = 1250 kg.
1250 kg − 750 kg = 500 kg
Let us write 500 kg in the kilogrammes column.

Let us subtract 3 t from the remaining 9 t in the metric tons column.
Then, 9 t − 3 t = 6 t
Let us write 6 t, in the metric tons column.

Therefore, the mass of the rice is 6 t 500 kg.

Method II

Let us express each mass in metric tons and then simplify.

10 t 250 kg = 10.250 t

3 t 750 kg = 3.750 t

10.250 t − 3.750 t = 6.500 t

6.500 t = 6 t 500 kg

t
10 . 250
− 3 . 750
6 . 500

The mass of the rice in the lorry is 6 t 500 kg.

Method III

Let us express each mass in metric tons and then simplify.

10 t 250 kg = 10 250 kg

3 t 750 kg = 3750 kg

10 250 kg − 3750 kg = 6500 kg

6500 kg = 6 t 500 kg

kg
10 250
− 3 750
6 500

The mass of the rice in the lorry is 6 t 500 kg.

Exercise 9.3

(1) Subtract the following.

(i)

t	kg
5	000
− 2	750

(ii)

t	kg
4	350
− 1	650

(iii) 250 t 650 kg − 150 t 105 kg

(iv) 60 t − 25 t 150 kg

9.5 Multiplication of a mass expressed in metric tons and kilogrammes by a number

➢ The mass of a concrete beam used to build a flyover bridge is 6 t 500 kg. Five such beams are placed across two columns. Let us find the total mass borne by the two columns.

The two columns bear 5 beams of mass 6 t 500 kg each. Hence, in order to find the mass borne by the two columns, 6 t 500 kg should be multiplied by 5.

Method I

Let us express 6 t 500 kg in kilogrammes and then multiply it by 5.

6 t 500 kg = 6500 kg

6500 kg × 5 = 32 500 kg

kg
6500
×5
32 500

32 500 kg = 32 t 500 kg

Accordingly, the total mass borne by the two columns is 32 t 500 kg.

Method II

t	kg
6	500
×	5
32	500

First, let us multiply 500 kg by 5.

500 × 5 kg = 2500 kg

2500 kg = 2000 kg + 500 kg = 2 t + 500 kg

Let us write 500 kg in the kilogrammes column.

Let us multiply 6 t by 5. 6 t × 5 = 30 t

Now let us add the 2 t obtained by the multiplication in the kilogrammes column, to the 30 t in the metric tons column.

30 t + 2 t = 32 t

Let us write 32 t in the metric tons column.

➢ Let us simplify 5 t 120 kg × 12.

Method I

t	kg
5	120
×	12
61	440

First let us multiply 120 kg by 12.

120 kg × 12 = 1440 kg = 1 t 440 kg

Now let us multiply 5 t by 12.

5 t × 12 = 60 t

∴ 5 t 120 kg × 12 = 60 t + 1 t 440 kg

= 60 t + 1 t + 440 kg

= 61 t 440 kg

5 t 120 kg × 12 = 61 t 440 kg

Method II

Let us express 5 t 120 kg in kilogrammes and multiply it by 12.

5 t 120 kg = 5120 kg

Let us multiply 5120 kg by 12.

5 120 kg × 12 = 61 440 kg

= 61 t 440 kg

kg
5120
× 12
10240
5120
61440

Example 1

(1) The mass of a tin of milk powder is 500 g. The mass of the empty tin is 50 g.

(i) Find the mass of the milk powder in such a tin, in grammes. Express this mass in kilogrammes.

(ii) A container is loaded with 1000 such tins of milk powder. Write the mass of these 1000 tins in kilogrammes and express it in metric tons also.

(i) The mass of a tin of milk powder = 500 g

The mass of the milk powder in the tin = 500 g – 50 g = 450 g

= 450 ÷ 1000 kg = 0.45 kg

(ii) The mass of 1000 tins of milk powder = 500 × 1000 g = 500 000 g

= 500 000 ÷ 1000 kg = 500 kg

= 500 ÷ 1000 t = 0.5 t

Exercise 9.4

(1) Simplify the following.

(i)

t	kg
160	200
	× 5

(ii)

t	kg
165	465
	× 4

(iii)

t	kg
32	45
	× 3

(iv) 16 t 325 kg × 12

(v) 5 t 450 kg × 25

(vi) 64.5 t × 50

(vii) 27.3 t × 25

(2) (i) The approximate mass of a car is 1 t 200 kg. Express the approximate mass of 10 such cars in metric tons.

(ii) The mass of a vehicle which transports these 10 cars is 20 t. Accordingly, express the total mass of the vehicle with these 10 cars, in metric tons.

9.6 Division of a mass by a whole number

➢ If a mass of 6 t 750 kg of rice is loaded equally into 5 lorries, let us find the mass of the rice loaded into one lorry. For this, 6 t 750 kg should be divided by 5.

Method 1

	t	kg
	1	350
5	6	750
	5	
	1 →	1000
		1750
		1750
		0000

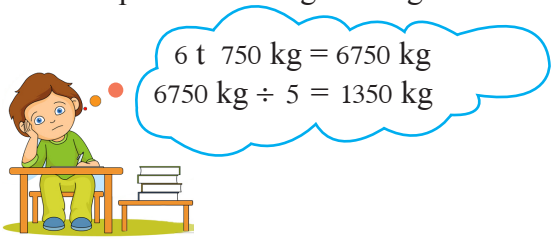
First, let us divide the metric ton quantity.
Since there is 1, 5s in 6, let us write 1 in the relevant position of the metric tons column where the answer should be written, and carry the remaining 1 t to the kilogrammes column as 1000 kg.

Next let us find the amount of kilogrammes in the kilogrammes column.
1000 kg + 750 kg = 1750 kg
Let us divide 1750 kg, by 5.
(1750 kg ÷ 5 = 350 kg)

The mass of the rice loaded into one lorry is 1 t 350 kg.

Method II

Let us express 6 t 750 kg in kilogrammes and divide it by 5.



	kg
	1350
5	6750
	5
	17
	15
	25
	25
	000
	000
	0

The mass of the rice loaded into one lorry is 1350 kg.

➢ A mass of 16 t 200 kg of paddy in a storehouse is loaded equally into 9 lorries. Let us find the mass of the paddy loaded into one lorry.

For this, 16 t 200 kg should be divided by 9.

Method I

	t	kg
	1	800
9	16	200
	9	
	7 →	7000
		7200
		7200
		0000

Let us divide the 16 t in the metric tons column by 9.
Let us carry the remaining 7 t to the kilogrammes column as 7000 kg.
Now let us find the amount of kilogrammes in the kilogrammes column.
7000 kg + 200 kg = 7200 kg
Let us divide 7200 kg by 9.
7200 kg ÷ 9 = 800 kg

The mass of the paddy loaded into one lorry is 1 t 800 kg.

Method II

Let us express 16 t 200 kg in kilogrammes and divide by 9.

16 t 200 kg = 16 t + 200 kg
= 16 000 kg + 200 kg
= 16 200 kg
16 200 kg ÷ 9 = 1800 kg

	kg
	1 800
9	16 200
	9
	72
	72
	00
	00
	00
	00

1800 kg = 1 t 800 kg

The mass of the paddy in one lorry is 1 t 800 kg.

Example 1

A lorry had to make 7 trips in order to transport a quantity of rice of mass 66.5 t. If the lorry carried an equal amount of rice on each trip, find the mass of the rice it carried on one trip.

$$\begin{array}{r|l} & t \\ & 9.5 \\ \hline 7 & 66.5 \\ & 63 \\ \hline & 3\ 5 \\ & 3\ 5 \\ \hline & 0 \end{array}$$

The mass of the rice carried by the lorry on 7 trips $= 66.5$ t

The mass of the rice carried by the lorry on one trip $= 66.5\ t \div 7$

$= 9.5$ t

Exercise 9.5

(1) Simplify the following.

(i) 5 t 200 kg ÷ 4 (ii) 12 t ÷ 5 (iii) 14 t 500 kg ÷ 5

(iv) 15 t ÷ 200 (v) 3 t ÷ 40 (vi) 17 t 300 kg ÷ 8

Summary

- Milligramme (mg), gramme (g), kilogramme (kg) and metric ton (t) are some units used to measure mass.
  1 g = 1000 mg 1 kg = 1000 g 1 t = 1000 kg
- In order to express a mass given in metric tons in kilogrammes, the quantity given in metric tons needs to be multiplied by 1000.
- In order to express a mass given in kilogrammes in metric tons, the quantity given in kilogrammes needs to be divided by 1000.