

9

Mass

After studying this lesson, you can get a good understanding of

- ★ the relation between kilograms and metric tonnes.
- ★ converting kilograms to metric tonnes and metric tonnes to kilograms
- ★ solving problems related to large masses.



There are many bags of cement in the lorry in the picture given above

What is the mass of a normal bag of cement?

When it is considered that there are 800 bags of cement in the lorry and the mass of a normal bag of cement is 50 kg. What is the mass of the cement in the lorry?

That value can be calculated as $800 \times 50 = 40000$ kg

40 000 kg is a large mass. The unit metric tonne which is a unit of measurement of mass can be used to express large masses.

$$1\ 000\ \text{kg} = 1\ \text{metric tonne (1t)}$$

Accordingly the mass of the cement in the lorry can be expressed as $\frac{40\ 000}{1000} = 40\ \text{t}$
(we can read it as 40 metric tonnes)

9.1 Conversion of kilograms to metric tonnes

Example 1

Express 80000 kg in metric tonnes.

$$80\ 000\ \text{kg} = \frac{80\ 000}{1\ 000} = \underline{\underline{80\ \text{t}}}$$

Example 2

Express 65200 kg in metric tonnes and kilograms.

$$\begin{aligned}65200 \text{ kg} &= 65000 \text{ kg} + 200 \text{ kg} \\ &= 65 \text{ t} + 200 \text{ kg} \\ &= \underline{\underline{65 \text{ t } 200 \text{ kg}}}\end{aligned}$$

This value can be expressed as

$$\frac{65\,200}{1\,000} \text{ t} = 65.2 \text{ t}$$

in metric tonnes only

Example 3

Express 1508.3 kg in metric tonnes and kilograms.

$$\begin{aligned}1508.3 \text{ kg} &= 1000 \text{ kg} + 508.3 \text{ kg} \\ &= 1 \text{ t} + 508.3 \text{ kg} \\ &= \underline{\underline{1 \text{ t } 508.3 \text{ kg}}}\end{aligned}$$

$$\frac{1508.3}{1000} \text{ t} = 1.5083 \text{ t}$$

$$1508.3 \text{ kg} = 1.5083 \text{ t}$$

Exercise 9.1

- (1) Convert the masses given in Kilograms to metric tonnes.
 - (i) 2 000 kg
 - (ii) 29 000 kg
 - (iii) 15 000 kg
 - (iv) 105 000 kg
 - (v) 500 kg
 - (vi) 1 200 kg
- (2) Express each of the following masses in metric tonnes and in kilograms.
 - (i) 11 200 kg
 - (ii) 2 005 kg
 - (iii) 61 025 kg
 - (iv) 12 345 kg
 - (v) 10 010 kg
 - (vi) 1001 kg
 - (vii) 8043 kg
 - (viii) 11501 kg
 - (ix) 100001 kg
- (3) Express in metric tonnes.
 - (i) 2 450 kg
 - (ii) 24 300 kg
 - (iii) 24 308 kg
 - (iv) 22758 kg
 - (v) 3475 kg
 - (vi) 9005 kg

9.2 Conversion of metric tonnes to kilograms

In certain instances it is needed to convert large masses given in metric tonnes to kilogrammes

Let us see how masses given in metric tonnes are converted to kilogramme

Example 4

Express a mass of 25 t in kg

$$25 \text{ t} = 25 \times 1000 \text{ kg} = \underline{\underline{25000 \text{ kg}}}$$

Example 5

- (i) Express 50.23 t in kilograms only
(ii) Write that value in metric tonnes and kilograms

$$\begin{aligned} \text{(i) } 50.23 \times 1000 \text{ kg} &= \underline{\underline{50230 \text{ kg}}} & \text{(ii) } 50.23 \text{ t} &= 50 \text{ t} + 0.23 \text{ t} \\ & & &= 50 \text{ t} + 0.23 \times 1000 \text{ kg} \\ & & &= 50 \text{ t} + 230 \text{ kg} \\ & & &= \underline{\underline{50 \text{ t } 230 \text{ kg}}} \end{aligned}$$

Example 6

Express 8 t 450 kg in kilograms

$$\begin{aligned} 8 \text{ t } 450 \text{ kg} &= 8 \text{ t} + 450 \text{ kg} \\ &= 8000 \text{ kg} + 450 \text{ kg} \\ &= \underline{\underline{8450 \text{ kg}}} \end{aligned}$$

Example 7

Express 0.25 t in kilograms.

$$0.25 \times 1000 = \underline{\underline{250 \text{ kg}}}$$

Exercise 9.2

(1) Convert the following masses to kilograms.

- | | | | |
|--------------|------------|--------------|----------------|
| (i) 5 t | (ii) 25 t | (iii) 12.5 t | (iv) 8.02 t |
| (v) 102.75 t | (vi) 0.8 t | (vii) 0.05 t | (viii) 0.007 t |

(2) Convert the following masses to kg.

- | | | |
|--------------------|--------------------|-------------------|
| (i) 2 t 200 kg | (ii) 10 t 250 kg | (iii) 11 t 245 kg |
| (iv) 25 t 5 kg | (v) 108 t 900 kg | (vi) 100 t 1 kg |
| (vii) 201 t 102 kg | (viii) 404 t 40 kg | (ix) 202 t 10 kg |

9.3 Addition of masses with metric tonnes

It happens practically that two or three masses with metric tonnes have to be added and expressed as one mass. let us consider the following examples.

Example 8

One lorry has 50 t of rice and another lorry has 35 t. What is the mass of the rice in both lorries?

$$\begin{array}{r} 50 \text{ t} \\ + 35 \text{ t} \\ \hline \underline{\underline{85 \text{ t}}} \end{array}$$

85 t of rice in both lorries.

Example 9

A lorry of mass 2.3 t is loaded with 4.5 t of wheat flour. Find the mass of the lorry with flour.

$$\begin{array}{r} 2.3 \text{ t} \\ + 4.5 \text{ t} \\ \hline \underline{\underline{6.8 \text{ t}}} \end{array}$$

The mass of the lorry with flour is 6.8 t.

Example 10

Find the total mass when a mass of 3 t 38 kg is added to a mass of 45 t 25 kg

$$\begin{array}{r} \text{t} \quad \text{kg} \\ 45 \quad 25 \\ + 3 \quad 38 \\ \hline \underline{\underline{48 \quad 63}} \end{array}$$

The total mass is 48 t 63 kg .

Example 11

Add a mass of 40 t 465 kg to a mass of 39 t 658 kg.

$$\begin{array}{r} \text{t} \quad \text{kg} \\ \rightarrow 1 \\ 39 \quad 658 \\ + 40 \quad 465 \\ \hline 80 \quad 123 \\ \hline \underline{\underline{1000 \quad 1123}} \\ \leftarrow \\ \text{1 remaining 123} \end{array}$$

$$\begin{array}{l} 658 \text{ kg} + 465 \text{ kg} = 1123 \text{ kg} \\ \quad \quad \quad = 1 \text{ t } 123 \text{ kg} \\ 1123 \text{ kg} \quad \quad = 1 \text{ t } 123 \text{ kg}. \\ 1 \text{ t in this should be taken to} \\ \text{the column of metric tonnes} \\ \text{and added} \end{array}$$

The total mass is 80 t 123 kg

Exercise 9.3

Add the following masses

$$\begin{array}{r} (1) \quad \text{t} \quad \text{kg} \\ 3 \quad 400 \\ + 2 \quad 300 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (2) \quad \text{t} \quad \text{kg} \\ 70 \quad 225 \\ + 25 \quad 765 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (3) \quad \text{t} \quad \text{kg} \\ 8 \quad 50 \\ + 3 \quad 469 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (4) \quad \text{t} \quad \text{kg} \\ 12 \quad 780 \\ + 8 \quad 220 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (5) \quad \text{t} \quad \text{kg} \\ 25 \quad 752 \\ + 38 \quad 800 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (6) \quad \text{t} \quad \text{kg} \\ 4 \quad 385 \\ + 3 \quad 755 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (7) \quad \text{t} \quad \text{kg} \\ 15 \quad 250 \\ 18 \quad 30 \\ + 5 \quad 890 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (8) \quad \text{t} \quad \text{kg} \\ 4 \quad 305 \\ 16 \quad 860 \\ + 11 \quad 088 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (9) \quad \text{t} \quad \text{kg} \\ 5 \quad 225 \\ 8 \quad 150 \\ + 13 \quad 175 \\ \hline \hline \end{array}$$

- (10) A lorry of mass 2 t 500 kg is loaded with 1 t 400 kg of flour, 2 t 800 kg of sugar, 3 t of rice and 400 kg of dhal. Find the total mass of the lorry.
- (11) In an aeroplane of mass 3 t 800 kg the mass of the passengers is 5 t 600 kg and the mass of baggage is 2 t 900 kg. Find the total mass of the plane.

9.4 Substraction of masses related to metric tonnes

Example 12

Find the mass remaining when a mass of 5 t 250 kg is subtracted from a mass of 8 t 350 kg .

$$\begin{array}{r} \text{t} \quad \text{kg} \\ 8 \quad 350 \\ - 5 \quad 200 \\ \hline \hline 3 \quad 150 \end{array}$$

The remaining mass is 3 t 150 kg

Example 13

Subtract the mass 25 t 400 kg from a mass 35 t 300 kg.

$$\begin{array}{r} \text{t} \quad \text{kg} \\ 35 \quad 300 \\ - 25 \quad 400 \\ \hline 9 \quad 900 \\ \hline \hline \end{array}$$

Answer is 9 t 900 kg

Since 300 kg cannot be subtracted from 400 kg, 1 t has to be taken from the column of metric tonnes.

1 t = 1000 kg
1000 kg is added to 300 kg
1300 kg - 400 kg = 900 kg

Example 14

Find the mass remaining when 65 t 927 kg is subtracted from 152 t 51 kg

$$\begin{array}{r} \text{t} \quad \text{kg} \\ 152 \quad 51 \\ - 65 \quad 927 \\ \hline 86 \quad 124 \\ \hline \hline \end{array}$$

Since 927 kg cannot be subtracted from 51 kg, 1 t is taken from the column of metric tonnes and added to 51 kg

Then 1051 kg - 927 kg = 124 kg

Mass remaining is 86 t 124 kg

Exercise 9.4

Subtract the following masses

$$(1) \begin{array}{r} \text{t} \quad \text{kg} \\ 58 \quad 165 \\ - 20 \quad 100 \\ \hline \\ \hline \hline \end{array}$$

$$(2) \begin{array}{r} \text{t} \quad \text{kg} \\ 32 \quad 820 \\ - 18 \quad 246 \\ \hline \\ \hline \hline \end{array}$$

$$(3) \begin{array}{r} \text{t} \quad \text{kg} \\ 13 \quad 456 \\ - 7 \quad 369 \\ \hline \\ \hline \hline \end{array}$$

$$(4) \begin{array}{r} \text{t} \quad \text{kg} \\ 124 \quad 800 \\ - 108 \quad 209 \\ \hline \\ \hline \hline \end{array}$$

$$(5) \begin{array}{r} \text{t} \quad \text{kg} \\ 8 \quad 480 \\ - 3 \quad 824 \\ \hline \\ \hline \hline \end{array}$$

$$(6) \begin{array}{r} \text{t} \quad \text{g} \\ 11 \quad 200 \\ - 8 \quad 555 \\ \hline \\ \hline \hline \end{array}$$

$$(7) \begin{array}{r} \text{t} \quad \text{kg} \\ 105 \quad 780 \\ - 28 \quad 890 \\ \hline \\ \hline \hline \end{array}$$

$$(8) \begin{array}{r} \text{t} \quad \text{kg} \\ 1 \quad 900 \\ - 0 \quad 999 \\ \hline \\ \hline \hline \end{array}$$

$$(9) \begin{array}{r} \text{t} \quad \text{kg} \\ 2 \quad 855 \\ - 1 \quad 200 \\ \hline \\ \hline \hline \end{array}$$

- (10) When a lorry entering the stores complex was weighed, the mass of the empty lorry was 4 t 800 kg. If the mass of it when it was leaving, loaded with cement was 10 t 200 kg. Find the amount of cement loaded.
- (11) A lorry was loaded with 20 t of rice. 12 t 250 kg of rice was distributed to the retail shops. Find the amount of rice remaining.

9.5 Multiplication of masses in metric tonnes

When it is needed to find the total mass of a number of equal masses, given in metric tonnes the multiplication of masses in metric tonnes is used. Consider the following example.

Example 15

The mass of rice in one store-room of a complex of store-rooms is 5 t 800 kg. Find the mass of rice in three such store-rooms.

t	kg		
2	5	800	
17	400	2400	
	1000		
	2	remaining 400	

$$800 \text{ kg} \times 3 = 2400 \text{ kg}$$

$$= 2 \text{ t } 400 \text{ kg}$$

$$5 \text{ t} \times 3 = 15 \text{ t}$$

$$15 \text{ t} + 2 \text{ t} = 17 \text{ t}$$

The total mass of rice in all the three store-rooms is 17 t 400 kg

Exercise 9.5

Do the following multiplications

- | | | | | |
|---|--|--|--|---|
| <p>(1) t</p> $\begin{array}{r} 20 \times \\ 5 \\ \hline \hline \end{array}$ | <p>(2) t</p> $\begin{array}{r} 40.5 \times \\ 8 \\ \hline \hline \end{array}$ | <p>(3) t kg</p> $\begin{array}{r} 3 \quad 20 \times \\ 3 \\ \hline \hline \end{array}$ | <p>(4) t kg</p> $\begin{array}{r} 52 \quad 50 \times \\ 4 \\ \hline \hline \end{array}$ | <p>(5) t kg</p> $\begin{array}{r} 1 \quad 800 \times \\ 6 \\ \hline \hline \end{array}$ |
| <p>(6) t kg</p> $\begin{array}{r} 8 \quad 250 \times \\ 8 \\ \hline \hline \end{array}$ | <p>(7) t kg</p> $\begin{array}{r} 12 \quad 225 \times \\ 4 \\ \hline \hline \end{array}$ | <p>(8) t kg</p> $\begin{array}{r} 28 \quad 222 \times \\ 5 \\ \hline \hline \end{array}$ | <p>(9) t kg</p> $\begin{array}{r} 24 \quad 710 \times \\ 7 \\ \hline \hline \end{array}$ | |

9.6 Division of masses in metric tonnes

Example 16

40 t of rice was loaded into 5 lorries in equal amounts. Find the amount of rice in each lorry.

$$40 \div 5 = 8$$

$$\text{Mass in one lorry} = \underline{\underline{8 \text{ t}}}$$

Example 17

There are 1250 t of rice to be distributed among flood victims. If that amount of rice was distributed among 8 Divisional Secretariats, find the amount of rice each Secretariat received.

$$\begin{array}{r} 156.25 \\ 8 \overline{) 1250} \\ \underline{8} \\ 45 \\ \underline{40} \\ 50 \\ \underline{48} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

One secretariat division received 156.25 t of rice. This value can be expressed as 156 t 250 kg.

Exercise 9.6

Do the following divisions

- (1) (i) $306 \text{ t} \div 5$ (ii) $30 \text{ t} \div 4$ (iii) $10 \text{ t } 400 \text{ kg} \div 4$ (iv) $12 \text{ t } 600 \text{ kg} \div 4$
(v) $15 \text{ t } 400 \text{ kg} \div 7$ (vi) $3 \text{ t } 800 \text{ kg} \div 6$ (vii) $25 \text{ t } 800 \text{ kg} \div 5$ (viii) $25 \text{ t } 800 \text{ kg} \div 6$
- (2) A lorry had to travel 12 times to remove 80 t of rice. Find the mass of rice taken by the lorry in one trip.
- (3) 11 t 600 kg of paddy has to be put into 200 bags equally. Find the mass that should be put into a bag.

- (4) The mass of 1 litre of water is 1 kg. Find the mass of 5500 litres of water in a bowser.
- (5) 400 bags of rice each of 50 kg are loaded in a lorry of mass 3 t 400 kg. Can this vehicle travel safely over a bridge which can bear the weight up to 20 t?
- (6) 14 concrete beams each 20 t are fixed between two posts in constructing a flyover. Find the total mass the two posts bear.
- (7) 10 tractors are used to transport metal from a quarry, each doing 5 trips a day carrying 4 t 500 kg of metal in each load. If the whole rock is removed as metal within 100 days, estimate the mass of the rock.
- (8) When constructing a 50 storeyed building, the estimated amounts of material needed are given below.

200 bags of cement each contains 50 kg

b 400 bags of sand each containing 50 kg

300 wheelbarrows of metal each containing 100 kg

200 steel rods each of weight 20 kg

Calculate the weight on the pillars of the first floor. If there are 10 such pillars, find the weight on each pillar bears.

Summary

- ★ A mass in kilograms is converted to metric tonnes by dividing it by 1000.
- ★ A mass in metric tonnes is converted to kilograms by multiplying it by 1000.
- ★ When adding masses given in metric tonnes and kilograms every 1000 kg has to be considered as a metric tonne.
- ★ In multiplying masses given in metric tonnes and kilograms, every 1000 kg has to be considered as a metric tonne.