20   Mass

By studying this lesson, you will be able to,
- identify the units used to measure mass,
- identify the relationship between the different units of mass and
- add and subtract masses given in terms of these units.

20.1   Introduction

The following figure depicts packets of tea leaves of different quantities which are found in the market. Observe the quantity that is written on each of the packets.

You may notice that the amount of tea leaves in each packet has been given in grammes (g) or kilogrammes (kg).

These quantities can be described as follows.

- The quantity of tea leaves in the first packet is 50 grammes.
  50 grammes has been denoted by 50 g.

- The quantity of tea leaves in the second packet is 500 grammes.
  500 grammes has been denoted by 500 g.

- The quantity of tea leaves in the third packet is 1 kilogramme.
  1 kilogramme has been denoted by 1 kg.

Now let us investigate the meaning of mass.

The mass of an object is a measure of the amount of matter in the object. Accordingly, the mass of the tea leaves in the packet with 50 g written on it is 50 g. Similarly the mass of the tea leaves in the other two packets are 500 g and 1 kg respectively.

The mass of the bag of rice is 50 kilogrammes; that is, 50 kg.

Grammes and kilogrammes are two units that are used to measure mass.

When we purchase items from the market, most often the quantities we buy are measured in grammes and kilogrammes.

The following figure depicts several standard weights and a balance scale which are used to measure mass.

A balance scale (weighing scale) is used to measure the mass of an object by comparing it with the mass of one or more standard weights.
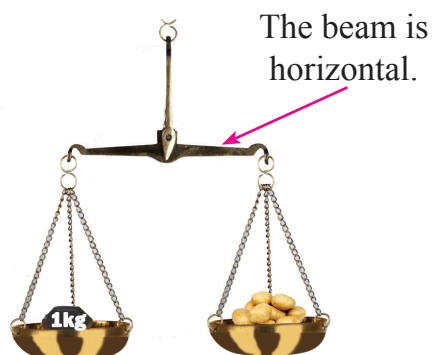
How 1 kg of potatoes is measured using a 1 kg standard weight is shown below. The standard weight that is used to measure the quantity is placed in one of the pans while the object is placed in the other pan.

Quantity of potatoes is less than 1 kg

Quantity of potatoes is more than 1 kg

The beam is horizontal.

When the beam of the scale is horizontal, the scale is balanced. Then the mass of potatoes in the pan is 1 kg.

Two 200 g standard weights can be used to measure 400 g of flour.

When a 500 g standard weight and a 100 g standard weight are available, 400 g of flour can be measured as depicted in the following figure.

500 g standard weight

Flour and 100 g standard weight

20.2   Various instruments that are used to measure mass

When a balance scale and standard weights are used, most often, amounts which are equal in mass to one or more standard weights are measured. The balance scale and standard weights shown on page 106 cannot be used to find the actual mass of an item such as a pumpkin of mass 425g.

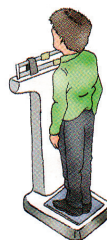In such a situation one of the instruments shown here can be used.

Two instruments that can be used to measure a mass such as your body mass are given here. When you stand on the instrument, the indicator shows what your mass is.

Exercise 20.1

State whether the mass of the matter in each of the following instances is more than 400 g, less than 400 g or equal to 400 g.

(i)   (ii)

(iii)

20.3 Relationship between different units of measuring mass

We have learnt that grammes and kilogrammes are two units that are used to measure mass.

The relationship between grammes and kilogrammes is given below.

    1000 g = 1 kg

The standard unit of measuring mass is the kilogramme.

Activity 1

A 1 kg standard weight has been placed in the left side pan of each of the following balance scales and the scale has been balanced by placing wooden blocks of equal mass in the right side pan. Write down the mass of a wooden block in each scale.

There are two wooden blocks.
Mass of a wooden block = ……

There are 4 wooden blocks.
Mass of a wooden block = ….

There are 10 wooden blocks.
Mass of a wooden block =…………

Let us see whether the masses you obtained are correct.

(i) Since 1 kg is 1000 g, the mass of the 2 wooden blocks is 1000 g. Therefore, the mass of one block is 500 g.

(ii) Since 1 kg is 1000 g, the mass of the 4 wooden blocks is 1000 g. Therefore, the mass of one block is 250 g.

(iii) Since 1 kg is 1000 g, the mass of the 10 wooden blocks is 1000 g. Therefore, the mass of one block is 100 g.

- **Express a mass given in kilogrammes in terms of grammes.**

Now let us consider how we express the mass of an object which has been given in kilogrammes, in terms of grammes.

Since   1 kg = 1000 g,
          2 kg = 2000 g
          3 kg = 3000 g

Accordingly, to express a mass given in kilogrammes, in terms of grammes, the given number of kilogrammes needs to be multiplied by 1000.

Example 1	Example 2
Express 7 kg in grammes.	Express 1 kg 250 g in grammes.
Since 1 kg = 1000 g,	Since 1 kg = 1000 g,
7 kg = 7 × 1000 g	1 kg 250 g = 1000 g + 250 g
= 7000 g	= 1250 g

Exercise 20.2

(1) Fill in the blanks.

(i) The number of 500 g amounts in 1 kg is ....

(ii) The number of 200 g amounts in 1 kg is ....

(iii) The number of 100 g amounts in 1 kg is ....

(iv) The number of 250 g amounts in 1 kg is ....

(v) The number of 125 g amounts in 1 kg is ....

(2) Fill in the blanks in each of the following parts by writing the appropriate mass in grammes.

(i) 1 kg   = 250 g + 100 g + 100 g + 50 g + ... g
(ii) 1 kg   = 150 g + 250 g + 100 g + ... g
(iii) 1 kg = 4 × ...... g   (iv) 1 kg = 8 × ...... g
(v) 1 kg   = 2 × ...... g   (vi) 1 kg = 1 × ...... g

For free distribution

(3) Fill in the blanks with a suitable value.

    (i) 500 g = 1 kg − ...... g   (ii) 250 g = 1 kg − ...... g

(4) Express the following masses in grammes.

    (i) 6 kg   (ii) 2 kg 500 g   (iii) 4 kg 150 g

    (iv) 1 kg 25g   (v) 15 kg 202 g   (vi) 6 kg 666 g

● **Express a mass given in grammes in terms of kilogrammes.**

Now let us express a mass given in grammes, in terms of kilogrammes.

Since 1000 g = 1 kg,
      2000 g = 2 kg
      3000 g = 3 kg

Accordingly, to express a mass given in grammes in terms of kilogrammes, the given number of grammes needs to be divided by 1000.

Example 1	Example 2
Express 9000 g in kilogrammes.	Express 2750 g in kilogrammes and grammes.

Example 1

Express 9000 g in kilogrammes.

Since 1000 g = 1 kg,

$$9000 \text{ g} = \frac{9000}{1000} \text{ kg}$$

$$= 9 \text{ kg}$$

Example 2

Express 2750 g in kilogrammes and grammes.

2750 g = 2000 g + 750 g

Since 1000 g = 1 kg,

2750 g = 2 kg + 750 g

2750 g = 2 kg 750 g

Accordingly, to express an amount of 1000 grammes or more, in terms of kilogrammes and grammes the amount of grammes is written as lesser than 1000.

Example 3

Complete the following table by expressing the masses given in grammes, in terms of kilogrammes and grammes.

g	kg	g
999	0	999
1000	1	000
6075	6	075
7009	7	009

(1) Express each of the following masses given in grammes, in terms of kilogrammes.

(i) 2000 g   (ii) 5000 g   (iii) 8000 g   (iv) 12 000 g

(2) Express each of the following masses given in grammes, in terms of kilogrammes and grammes.

(i) 3500 g   (ii) 2065 g   (iii) 4005 g   (iv) 3250 g   (v) 10 050 g

(3) Complete the following table by expressing the masses given in grammes, in terms of kilogrammes and grammes.

g	kg	g
875	....	....
1035	....	....
....	1	005
3015	3	....
4380	....	....
....	8	150
12565	....	565

20. 4   Adding masses

Let us find the mass of the mixture that is obtained when 250 g of sugar is added to 500 g of "Thriposha".

Both the masses have been given in grammes. Since both masses have been given in the same unit let us add them as shown here.

500 g
250 g
750 g

The mass of the mixture is 750 g.1 kg 500 g of flour, 1 kg 250 g of sugar and 1 kg 500 g of margarine are mixed together to prepare a cake.

Let us find out what the mass of the mixture is.

When adding these masses which have been given in terms of kilogrammes and grammes, it is necessary to write the kilogrammes in one column and the grammes in a different column.

kg	g
1	500
1	250
+ 1	500
4	250

Let us add the values in the grammes column.
500 g + 250 g + 500 g = 1250 g
1250 g = 1000 g + 250 g
Since 1000 g = 1 kg, 1250 g = 1 kg + 250 g
Let us write the 250 g in the grammes column.
Let us carry the 1 kg to the kilogrammes column.
Then the sum of the values in the kilogrammes column is,
1 + 1 + 1 + 1 , which is 4. That is, 4 kg.
Therefore, the answer is 4 kg 250 g.

Example 1

kg	g
2	750
+ 1	450
4	200

Let us add the amounts in the grammes column.
750 g + 450 g = 1200 g
1200 g is 1 kg and 200 g.
Let us write the 200 g in the grammes column.
Let us carry the 1 kg to the kilogrammes column.
Then the sum of the values in the kilogrammes column is,
1 + 2 + 1, which is 4.
Therefore, the answer is 4 kg 200 g.

Exercise 20.4

(1) Write down the answers to each of the following in terms of kilogrammes and grammes.

(i) kg	g		(ii) kg	g		(iii) kg	g
2	750		3	65		5	623
+ 1	250		+ 2	150		+ 3	750

(iv) kg	g	(v) kg	g	(vi) kg	g
3	150	1	75	1	50
2	750	2	250	2	250
+ 1	400	+ 1	800	+ 1	850

(2) Find the total mass of 2 kg of rice, 1 kg of sugar, 250 g of tea leaves, 500 g of flour and 250 g of red onions that were bought at a market.

(3) The mass of an empty gas cylinder is 3kg 750 g. If gas of mass 12 kg 500 g has been filled into the cylinder, what is the mass of the cylinder with the gas?

(4) A parcel of dry rations given to a family affected by floods contained the following quantities of the given items.

5 kg of rice	500 g of dry fish	500 g of flour
1 kg of sugar	2 kg 500 g of lentils	250 g of tea leaves

Find the total mass of these items.

(5) A piece of pumpkin of mass 1 kg 350 g was cut from a whole fruit and sold. The mass of the remaining portion was 2 kg 850 g. Find the mass of the whole fruit.

(6) The masses of two pumpkins that grew on the same creeper were 2.35 kg and 3.8 kg respectively. What is the total mass of the two fruits?

20.5 Subtracting masses

A housewife left 2 kg 750 g of black peppers that she had obtained from her garden, out in the sun to dry for several days. When she weighed it again she found that the mass had reduced to 1 kg 200 g. Let us find the quantity by which the mass had reduced during the drying process.

To find the amount by which the mass had reduced during the drying process, the mass of the dried peppers has to be subtracted from the mass of the fresh peppers. To do this, let us write them one below the other, such that the gramme values are in one column and the kilogramme values are in another column.

```
kg    g
 2   750
-1   200
 1   550
```

By subtracting we obtain 1 kg 550 g. Therefore, the mass of the peppers has reduced by 1 kg 550 g during the drying process.

Example 1

The mass of a box containing biscuits is 2kg 250 g. If the mass of the empty box is 750 g, find the mass of the biscuits in the box.

```
 kg    g
  2   250
- 0   750
  1   500
```

Since 750 g cannot be subtracted from 250 g, let us convert 1 kg into grammes and add it to the 250 g.
Then 1000 g + 250 g = 1250 g
Now, 1250 g − 750 g = 500 g
There is only 1 kg remaining in the kilogramme column now. Therefore, the mass of the biscuits in the box is 1 kg 500 g.

Exercise 20.5

(1) Subtract the following.

(i)	kg	g		(ii)	kg	g		(iii)	kg	g
	3	200			2	750			4	000
−	1	100		−		500		−	2	500

(iv)	kg	g		(v)	kg	g		(vi)	kg	g
	3	250			4	050			6	025
−	1	500		−	2	200		−	2	250

(2) The water in 1 kg of tea leaves was removed by drying the leaves. The mass of the dried tea leaves was 180 g. What is the mass of the water that was removed?

(3) The edible portion of a jackfruit of mass 3 kg was of mass 1 kg 650 g. What was the mass of the portion of the fruit that was discarded?

(4) The quantity of sugar in Nimal's house on Monday morning was 1 kg 500 g. On Tuesday morning, there was 800 g remaining. What was the mass of sugar that was consumed during this period?

(5) From the 12 kg 750 g stock of lentils that was in a shop one morning, 8 kg 250 g remained at the end of the day. Find the mass of lentils that was sold during that day.

(6) The mass of a gas cylinder with the gas is 13 kg 250 g. The mass of the empty gas cylinder is 2 kg 450 g. Find the mass of the gas that is in the cylinder.

(7) There was 5.85 kg of rice in a bag. If 2.17 kg of this quantity was used for a meal, how many kilogrammes of rice was left over?

Miscellaneous Exercises

(1) Fill in the blanks.

(i)
$$
\begin{array}{ccc}
 & \text{kg} & \text{g} \\
 & 2 & 250 \\
+ & \Box & \Box \\
\hline
 & 4 & 75 \\
\hline
\end{array}
$$

(ii)
$$
\begin{array}{ccc}
 & \text{kg} & \text{g} \\
 & 3 & 500 \\
- & \Box & \Box \\
\hline
 & 1 & 750 \\
\hline
\end{array}
$$

(2) The masses of three parcels that were brought to a post office were respectively 2 kg 500 g, 3 kg and 1 kg 750 g. Express the total mass of the three parcels in kilogrammes and grammes.

(3) The masses of the items in a student's school bag are given below.

Mass of the textbooks	=	4 kg 750 g
Mass of the exercise books	=	2 kg 400 g
Mass of the lunch packet	=	550 g
Mass of the water bottle	=	375 g

The student says that the total mass of the items in his school bag does not exceed 10 kg. Show with reasons whether this statement is true or false.

(4) The mass of a bag of rice is 5.35 kg. If the mass of the empty bag is 0.75 kg, find the mass of the rice in the bag.

(5) An aircraft passenger is allowed to carry a bag of personal items of mass 30 kg at no extra cost. If a person has bought items of total mass 14 kg 750 g to be taken on an aircraft, what is the mass of items he can buy to make up his quota of 30 kg ?

Summary

- Most often, grammes and kilogrammes are used to measure mass.
  1000 g = 1 kg

- To express a mass given in kilogrammes in terms of grammes, the mass in kilogrammes is multiplied by 1000.

- To express a mass given in grammes in terms of kilogrammes, the mass in grammes is divided by 1000.