6   Mass

After studying this chapter you will be able to get a good understanding of;

★ identifying the relation between milligrams and grammes.
★ estimation of mass.
★ adding and subtracting masses of units of milligrams, grammes and kilograms.
★ multiplication and division of masses of units of milligrams, grammes and kilograms.
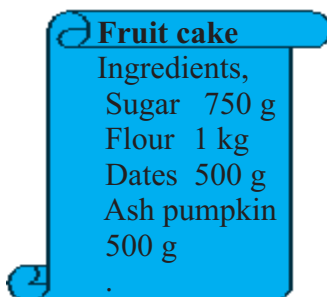
6.1 Different units of measure for measuring mass

(i)

5mg 5mg 5mg

(ii)

(iii)

50 kg
50 kg
50 kg
50 kg

(iv)

Fruit cake
Ingredients,
Sugar   750 g
Flour   1 kg
Dates   500 g
Ash pumpkin
500 g
.

(v)

THERE WE ARE FOLKS, 202.5 KILOGRAMS!

In your day- to- day activities, when buying things and using them you apply various measurements to measure their quantities and to state them. Among them there are measurements related to mass too. What is given above are a few such measurements.

Prepare a table as shown below.
(i)   Using information about materials and their quantities which are brought to your home within a week.
(ii) Using labels and wrappings of various materials you bring to your home.

Article	Measurement	Whether a unit of mass or not
Sugar	kg	a unit of mass
Coconut oil	*l*	Not a unit of mass
Medicinal tablets	mg	a unit of mass

Excercise 6.1

(1)   Given below is the composition of nutritional value a person gets when he intakes 20g of some variety of margarine.

|	
Protein	0.083 g
Carbohydrate	0.208 g
Fat	14.0 g
Cholesterol	0.3 mg
Lactose	208 mg
Sodium	138 mg

Rest are other substances.
(i)   Write down the materials which are given in milligrams.
(ii) Name another material you will use in day- to -day life of which the mass is stated in milligrams.

(2)   What are the suitable units, to measure the mass of the following materials?

      (i)   Rice needed for the home.
      (ii)   Milk powder.
      (iii)   Margarine.
      (iv)   A medicine capsule
      (v)   A quantity of rock salt added to a dose of ayurvedic medicine.

6. 2 Conversion of units of measuring mass

Activity 6.2
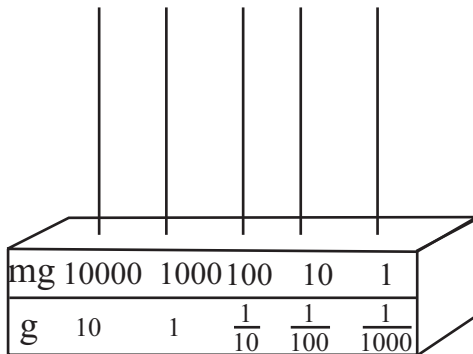
Milligrams are denoted by 'mg' grammes by 'g' and kilograms by 'kg'.

mg	10000	1000	100	10	1
g	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Observe carefully the above abacus. Under each rod the number of grammes and milligrams represented by it is mentioned.

Fill in the blanks in the table given below using the above information.
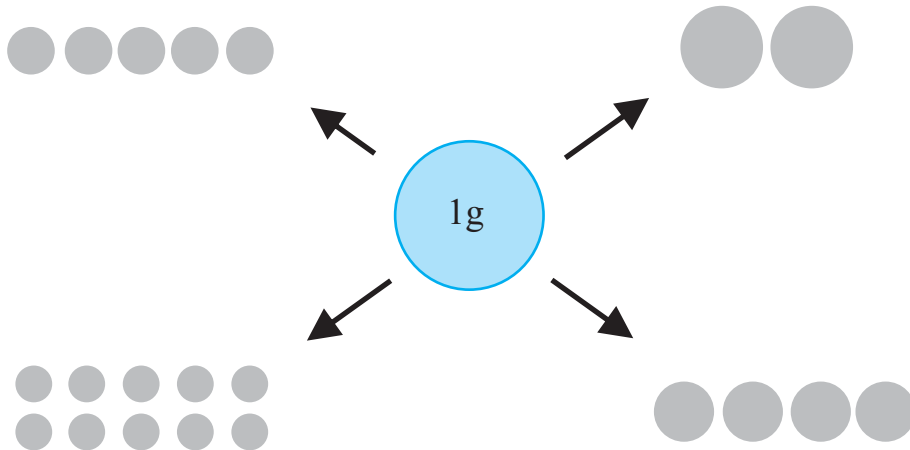
mg	g
1	
10	
100	
1000	

$$1000 \text{ mg} = 1 \text{ g}$$

Accordingly you will see that 1 g is 1000 mg.

Shown in the figure are four situations in which (Kalka Guli) paste pills of equal size are made from one paste pill of mass 1 gramme.

(1) What is the mass of the 'Kalka Guli' (pill of Ayurwedic medicine) in milligrams?

(2) What is the mass of one 'Kalka Guli' pill in milligrams when it is divided into two equal small pills ?

(3) What is the mass of a part of 'Kalka Guli' in milligrams when it is divided into four equal parts (pills) ?

(4) What is the mass of a part of 'Kalka Guli' (pill) in milligrams when it is divided into five equal parts?

(5) What is the mass of a part of 'Kalka Guli' in milligrams when it is divided into ten equal parts?

Example 1

Express 2 250 milligrams in grammes and milligrams.
$$2\,250\,\text{mg} \quad = \quad \underline{2000\,\text{mg} + 2}50\,\text{mg}$$

Example 2

Show 6.25 grammes in milligrams.

$$1\,g \quad = \quad 1000\,mg$$
$$\therefore \quad 6.25\,g \quad = \quad 6.25 \times 1000\,mg$$
$$= \quad \underline{6\,250\,mg}$$

Example 3

Express a mass of 325 milligrams in grammes .

$$1000\,mg \quad = 1\,g$$
$$1\,mg \quad = \frac{1}{1000}\,g$$
$$325\,mg \quad = 325 \times \frac{1}{1000}\,g$$
$$= \frac{325}{1000}\,g$$

$$= \underline{0.325\,g}$$

Example 4

Show in milligrams a mass of 4.075 grammes.

$$4.075\,g \quad = \frac{4075}{1000}\,g$$
$$= 4\,g + \frac{75}{1000}\,g$$
$$= 4000\,mg + 75\,mg$$
$$= \underline{4\,075\,mg}$$

$$\frac{1}{1000}\,g = 1\,mg$$

$$\frac{75}{1000}\,g = 75\,mg$$

Another method

$$1\,g \quad = \quad 1000\,mg$$
$$4.075\,g \quad = \quad 1000 \times 4.075\,mg$$
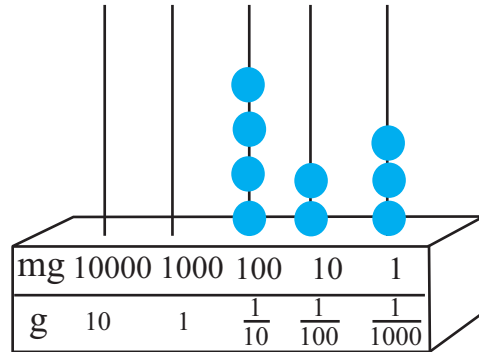$$= \quad \underline{4\,075\,mg}$$

Exercise 6.2

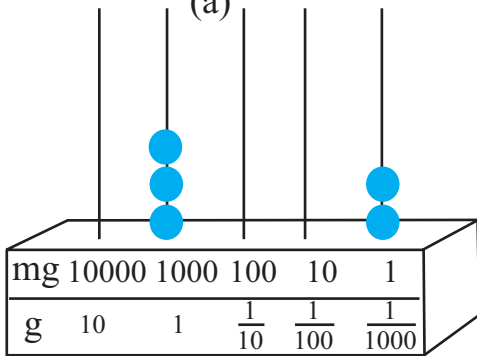(1) Write the masses, illustrated by the counting frames in,

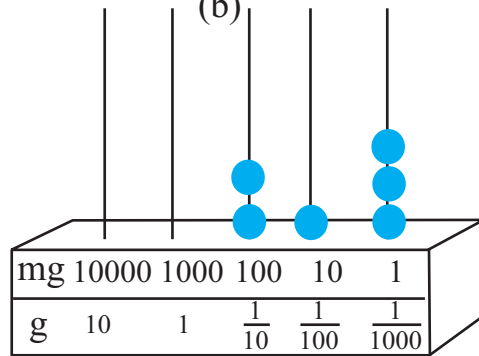(i) milligrams   (ii) grammes and milligrams
(iii) grammes (with decimals)
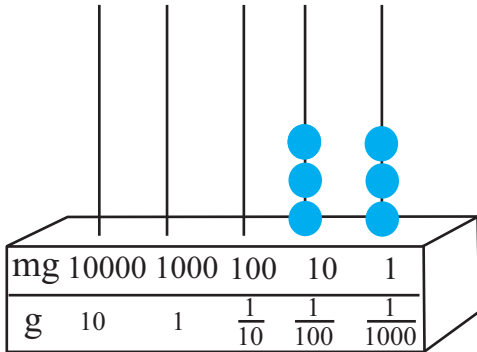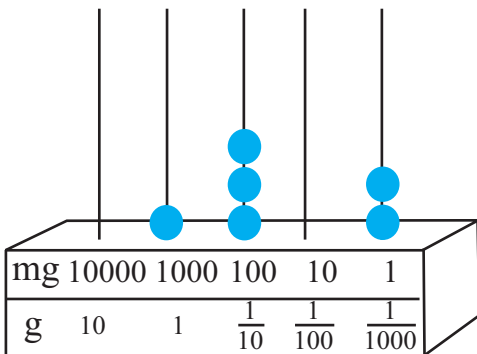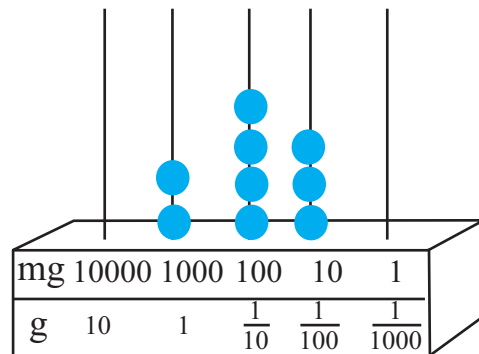

(a)

(b)

(c)

(d)

(e)

(f)

(2)   The following are masses given in milligrams. Express them in grammes and milligrams.

    (i)   1 750 mg   (ii)   3 500 mg   (iii)   1 650 mg

    (iv)   1 005 mg   (v)   4 000 mg

(3)   Express the masses given below in milligrams.

    (i)   5 g   (ii)   12 g   (iii) $\frac{1}{2}$ g   (iv) $\frac{1}{4}$ g
    (v) $2\frac{1}{2}$ g   (vi) $1\frac{1}{5}$ g

(4)   Express in grammes the masses given below.

    (i)   500 mg   (ii)   750 mg   (iii)   125 mg

    (iv)   250 mg   (v)   105 mg   (vi)   80 mg

    (vii)   5mg   (viii) 1 425 mg   (ix)   3 245 mg

    (x)   2 008 mg

(5)   Convert into milligrams.

    (i) 4g   (ii) $1\frac{1}{2}$ g   (iii) $\frac{3}{5}$ g   (iv) $1\frac{3}{5}$ g   (v) $1\frac{7}{10}$ g

(6)   Copy down the masses given below in your exercise
       book and fill in the blanks.

(i) | 2325 mg | → | .... g ....mg |
                       | .... g |

(ii) | 3.275 g | → | .... g ....mg |
                       | .... mg |

(iii) | 5.750 g | → | .... g ....mg |
                       | .... mg |

(iv) | 1.075 g | → | .... g ....mg |
                       | .... mg |

(v) | 4 g 125 mg | → | .... g |
                          | .... mg |

(vi) | 3 g 25 mg | → | .... g |
                         | .... mg |

(7)   Fill in the blanks of the table given below.

In grammes	In grammes and milligrams	In milligrams
(i) 1.300g	1g 300 mg	1300 mg
(ii) 3.250g	....	....
(iii)	2g 750 mg	....
(iv)	....	1955 mg
(v) 4.005g	....	....
(vi)	....	50 mg

6. 3 Estimation of Mass

You will face situations where a rough idea of mass of certain things you come across has to be   taken   without   the use of a measuring instrument of mass. Expressing such a rough value is called **estimation**.

Mass of a tablespoon of sugar is about 10 g.

How many tablespoons of sugar are there in 500 grammes of sugar?

How many cups of tea can be prepared using 2 tablespoons of sugar?

How many cups of tea can be prepared by using 1 tablespoon of sugar?

Accordingly, what is the quantity of sugar that should be bought to prepare 200 cups of tea?
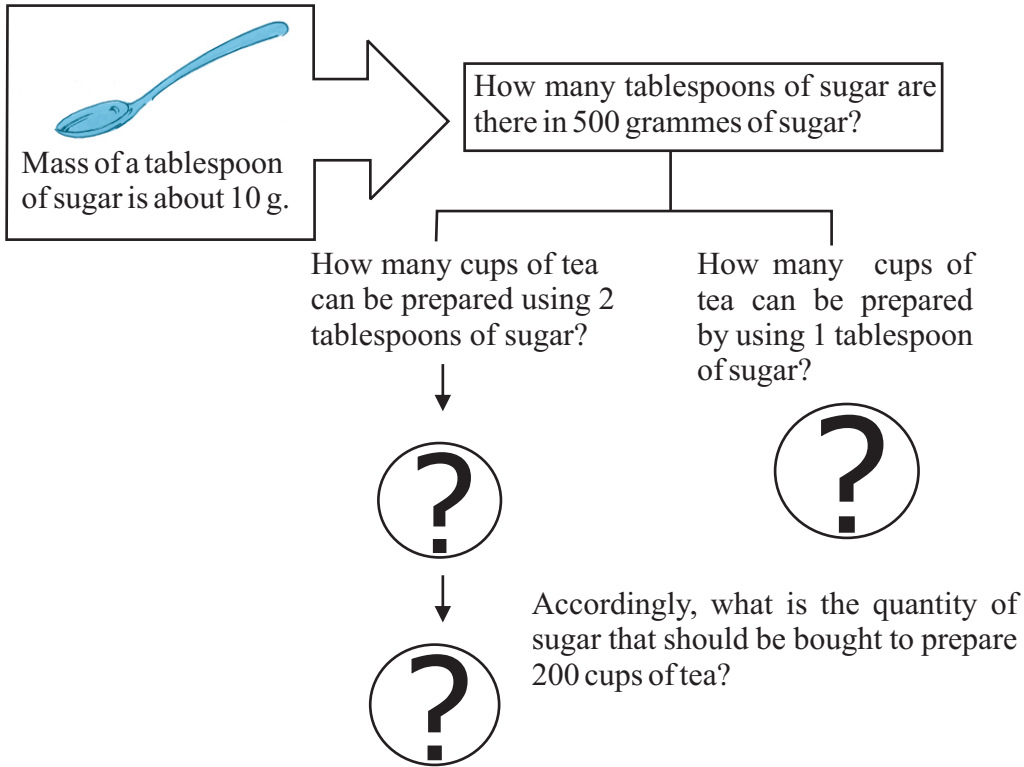
Estimate the necessary quantities.

Activity 6.5

A packet of milk powder, sufficient to prepare a cup of tea for one person is shown here. Packets of milk powder with a mass of 450 g in each, suitable for preparing tea are available in the market.

(I)   About how many cups of tea can be prepared with a packet of 450 g of milk powder?

(ii)   A family of 5 members drinks cups of tea prepared with milk powder twice a day. Find in grammes the mass of milk powder necessary for them per day.

(iii)   Accordingly, find for how many days will a packet of milk powder of 450 g of the same brand be sufficient for that family?

(1) Estimate, the mass of each of the articles mentioned below. (for this purpose, hold up by hands the weights 50 g, 100 g or 200 g and get an idea about masses of them and use your experience.)

      (i)   A box of matches
      (ii)   A cup of water
      (iii)   A five rupee coin
      (iv)   A beaker of 250 ml filled with water
      (v)   A soft drink bottle of 350 millilitres

(2) Fill in the blanks of the second column of the table given below, by estimating the mass of each of the given articles in the first column. Find the actual masses and fill the third column.

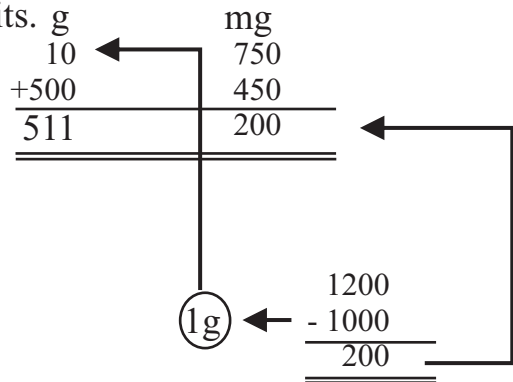| Article	Estimated mass	mass
(i) A cake of toilet soap	....	....
(ii) A cake of washing soap	....	....
(iii) A normal bun	....	....
(iv) An average coconut	....	....
(v) A packet of biscuits	....	....
(vi) A comb of plantains	....	....
(vii) A papaw	....	....

(3) What will be the average mass of a daily newspaper ?
Accordingly, how many newspapers will be necessary for a

(4)   The mass of an average lime is about 50 g. Estimate the mass of 20 such limes.

6.4 Addition and Subtraction of masses.
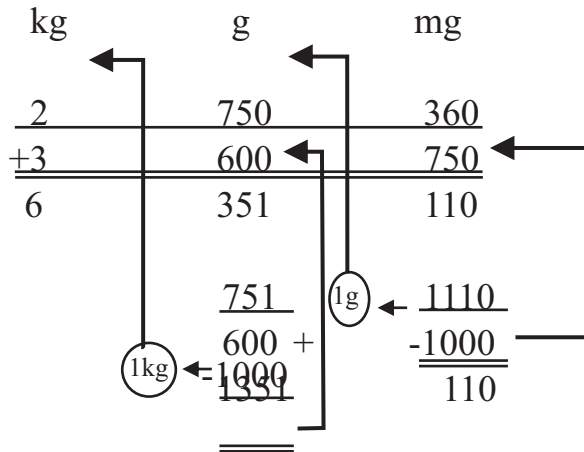
Example 5

The mass of an empty biscuit packet is 10 g and 750 mg. The mass of biscuits it can hold is 500 g and 450 mg. Find the mass of the packet with biscuits.

```
      g          mg
     10         750
   +500         450
    511         200
```

```
            1200
  (1g)  ←  - 1000
             200
```

∴ The mass of the packet with biscuits = 511 g 200 mg.

Example 6

Add 2 kg 750 g 360 mg and 3 kg 600 g 750 mg.

```
    kg          g          mg
     2         750         360
    +3         600         750
     6         351         110
```

```
           751    (1g) ←  1110
           600 +        -1000
  (1kg)←=1000             110
           1331
           351
```

The sum = 6 kg 351 g 110 mg.

● $360 \, mg + 750 \, mg \rightarrow 1110 \, mg$
We know that 1000 mg = 1g, therefore take 1g to the gramme column and write the remaining part (1110 - 1000) 110mg, in the mg column.

● $750 \, g + 600 \, g + 1 \, g = 1351 \, g$
We know that 1000 g = 1 kg, therefore take 1kg to the kg column and write the remaining part (1351-1000)   351g in the grammes column.

Exercise 6.4

(1)   Add the masses given below.

(i)
mg
+ 205

(ii)
mg
+ 645

(iii)
g	mg
+ 2	400

(iv)
g	mg
+ 200	265

(v)
g	mg
+ 800	450

(vi)
kg	g	mg
+ 3	600	500

(vii)
kg	g	mg
+ 4	675	325

(viii)
kg	g	mg
+ 6	830	800

(ix)
kg	g	mg
+ 4	845	785

(2)   The mass of an empty gunny bag is 750 g and 300 mg. There is a quantity of rice with a mass of 75 kg 500 g and 300 mg in it. Find the mass of the gunny bag with rice.

Example 7

Subtract 250 g 400 mg from 750 g and 300 mg.

g	mg
750	300
- 250	400
499	900
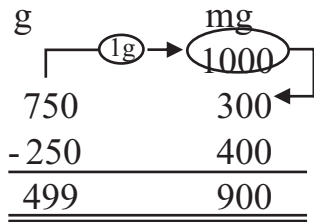
★   400 g cannot be subtracted from 300 g. Therefore take 1 from gramme column to milligrams column. One gramme is equal to 1000 milligrams. Therefore when 1 gramme from the grammes column is taken to the milligrams column, it is converted into 1000 mg.

Then,

$1000 + 300 \rightarrow 1300$ mg

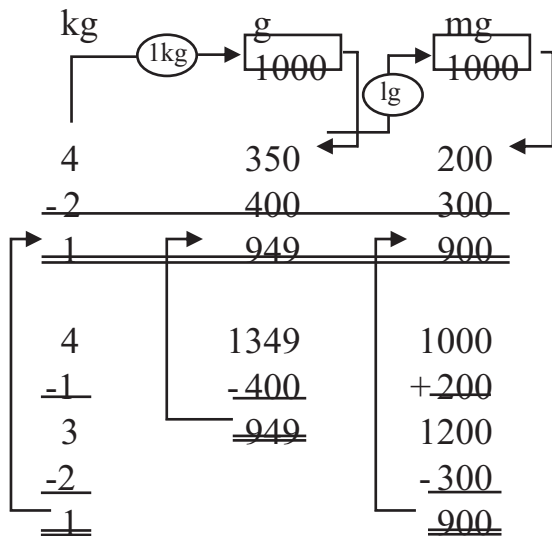When 400 mg is subtracted from 1300 mg, the answer is 900 mg.

Now we have 749 - 250 in the column of grammes.

↟(Since 1 g from grammes column is taken to mg column)

Then the difference is 499 g.

Example 8

Subtract 2 kg 400 g 300 mg from 4 kg 350 g 200 mg.

kg	g	mg
4	350	200
-2	400	300
1	949	900
4	1349	1000
-1	-400	+200
3	949	1200
-2		-300
1		900

★ 300 mg cannot be subtracted from 200 mg. Therefore 1 g is taken to mg column from the grammes column. Then it is written as 1000 mg in the mg column. So, when 300 is subtracted from 1200 mg the result is 900 mg.

★ Now there is 349 in the grammes column. It is not possible to subtract 400 from it. Therefore when 1 kg is taken from the kilograms column to the grammes column, it is converted into 1000 g. Now there is 1349 in the grammes column. When 400 g is subtracted from 1349 g the result is 949g.

★ Now there is 3 in the kilograms column. When 2 is subtracted from it, the result is 1 kg.

Exercise 6.5

(1) Subtract

(i)

g	mg
200	150
- 150	75

(ii)

g	mg
350	400
- 200	500

(iii)

kg	g	mg
5	500	350
- 2	200	600

(iv)

kg	g	mg
4	200	150
- 1	300	200

(v)

kg	g	mg
5	150	350
- 2	450	400

(vi)

kg	g	mg
5	450	200
- 2	500	300

(2) The weight of a gunny bag with rice is 75 kg and 350 g. The weight of the empty gunny bag is 2 kg 200 g and 350 mg. Find the net weight of rice in the gunny bag.

(Net weight = Weight of the gunny bag with rice - weight of the gunny bag)

(3) There is a packet of washing powder with a net weight of 50 g. When it was weighed, using a microbalance, the answer was 50 g and 400 mg. Find the mass of the empty packet.

(4) These are the readings of a procedure, planned by Sithumini to find the mass of her pretty cat.
Mass of Sithumini when she is holding her cat   = 30 kg 450 g
Mass of Sithumini without cat   = 28 kg 700 g
Find the weight of the cat.

(5) Sithumini's father brought home 2 kg of dhal on Monday. Her mother used 250 g of dhal on Monday, 200 g of dhal on Wednesday and 400 g of dhal on Friday to prepare their meals. What is the remaining mass of dhal on Saturday?

(6) A fish vendor brought for sale, 12 kg and 500g of fish. By 2.00p.m. he had only a mass of 4 kg 750g of fish. What is the quantity of fish the vendor has sold by that time?

(7) The mass of a gunny bag with vegetables was   50 kg 400 g. During transportation some   quantity of water has evaporated. When   measured after transporting, the mass was 48 kg 500 g and 250 mg. What is the mass of evaporated water?

(8) The mass of a ball before inflating was 1 kg 900 g. When inflated the mass is 2 kg 100 g 200 mg. Find the mass of air filled into the ball.

Example 9

$$
\begin{array}{cc}
\text{g} & \text{mg} \\
3 & 400 \\
& \times\ 3 \\
\hline
10 & 200 \\
\hline
\end{array}
$$

❋ $400\,\text{mg} \times 3 = 1200\,\text{mg}$

❋   1200 mg is equal to 1 g and 200 mg. So write 200 mg in the mg column and bring 1 g to grammes column.
    3 g × 3 ⟶ 9 g. When 1 g brought from the mg column is added. It is 10 g.

Example 10

$$
\begin{array}{ccc}
\text{kg} & \text{g} & \text{mg} \\
2 & 400 & 350 \\
& & \times\ 4 \\
\hline
9 & 601 & 400 \\
\hline
\end{array}
$$

❋   350 mg × 4 ⟶ 1400 mg. 1000 mg = 1 g, when 1400 is divided by 1000 the answer is 1 g and 400 mg. Write 400 mg in mg column. Bring 1 g to grammes column.

❋   400 g × 4 ⟶ 1600g. When 1 g brought from mg column is added to 1600 g the answer is 1601 g.

❋   1601 g is equal to 1 kg and 601g. Write 601 g in grammes column. Bring 1 kg to the kg column.

❋   2 kg× 4 ⟶ 8 kg .When 1 kg which is brought from the right hand column is added, the answer is 9 kg.

(1) Multiply

(i) mg
     400
    × 2
    ─────

(ii) mg
     600
    × 3
    ─────

(iii) g   mg
       5   300
             × 3
    ─────────────

(iv) g   mg
      2   450
          × 3
    ─────────────

(v) g   mg
     600   750
          × 2
    ─────────────

(vi) kg   g   mg
     2   700   500
              × 2
    ─────────────────

(vii) kg   g   mg
      2   650   550
               × 2
    ─────────────────

(viii) kg   g   mg
       3   675   400
                × 3
    ─────────────────

(2) Fill in the blanks.

The mass of the wrapper of a packet of tea   = 400 mg
Net mass of a packet of tea   = 250 g
The mass of the packet of tea with its wrapper   = ...
The mass of 25 such packets of tea   = ...
The mass of the empty box which is used to
pack 25 packets of tea   = 400 g 500 mg
The mass of the box with 25 packets of tea   = ...

(3) Menthol is added to hot water and inhaled the vapour to get a fast relief from disturbances in the respiratory track.

A doctor gives 10 mg of menthol powder to a patient as 20 packets in equal quantities. If he uses one packet at a time, what is the number of milligrams of powder taken at a time?

(4) The mass of a box of biscuits is 2 kg 500 g. Find the mass of ten such boxes of biscuits.

(5) Packets of tea are sent to the market, with a mass of 200g of tea leaves and the wrapper with a mass of 400 mg, for each packet.

What is the mass of 20 such tea packets? Those 20 packets are packed in a box of mass 400 g 350 mg. Find the mass of such a box.

6.6 Division of mass including mg , g , kg

Example 11

Divide 3g 600mg by 2

```
            g       mg

          ┌──────────────────┐
          │  1      800       │
          │                   │
     2    │  3──    600       │    When divided by 2
          │  2  →   ─────      │
          │  1      1000       │
                    1600
```

When 3 g is divided by 2 the answer is 1. Another 1 g will remain. When the remaining 1 g is taken to the milligrams column it is 1000 mg and when the 600 mg in the column is added to it the sum is 1600mg. When it is divided by 2 the answer is 800 mg.

Example 12

★ Let us divide 4kg 500 g by 3.

```
        kg              g
         1            500
    3  | 4            500
       | 3
       | 1    ───►   1000        When divided by 3
                     1500
                  −  1500
                       0
```

★ Find the quantity of cereal, one person gets when 6 kg 450 g of cereal is divided equally among 4 persons.

```
         kg           g              mg
          1          612            500
    4  |  6          450            000        When divided
       |  4                                    by 4
       |  2   ───►   2000      When divided
                     2450      by 4
                  −  2448
                        2  ───►   2000
                              −   2000
                                  0000
```

Exercise 6.7

(1) Divide
    (i)   801 g 200 mg ÷ 2
    (ii)   1 kg 501 g 50 mg ÷ 3
    (iii) 1 kg 51 g 350 mg ÷ 3
    (iv) 18 kg ÷ 4
    (v)   10 kg 501 g 800 mg ÷ 3

(2) The net weight of washing powder in a packet is 2 kg 409 g. A housewife uses equal amounts of washing powder measuring with a plastic cup, for washing clothes. When she used it 12 times, the washing powder was finished. Find the mass of washing powder that the plastic cup can hold.

(3) The mass of 6 cakes of soap of the same brand is 903 g. Find the mass of one cake of soap.

(4) Fill in the blanks.

The weight of a box with 50 packets of chocolate	= 5 kg 225 g 750 mg
The weight of the empty box	= 200g 750 mg
The weight of 50 packets of chocolate	= ....
The weight of a packet of chocolate	= ....
The mass of the wrapper of a packet of chocolate	= 500 mg
The net weight of a chocolate	= ....

Summary

✶   The units of **mg** and **g** are used to measure masses of small size.

✶   **1000 mg is equal to 1 g.**

✶   Using the relationship among mg, g and kg addition, subtraction, multiplication and division, of masses of mg, g, and kg can be done.