

CHAPTER

22

Measure Mass

Chapter Outcomes:

- Demonstrate an understanding of the relationship between standard units and their sub-parts to solve practical problems involving mass.
- Apply algebraic reasoning to calculate unknown values involving mass.
- Solve problems involving mass.



Each year, worldwide, products are bought and sold according to their measurement of mass. This measurement allows buyers and sellers to trade fairly with each other. Every time we purchase food for ourselves or for our pets we want to be sure that the quantity we receive is accurate and that it is of the best value. For example, if we are purchasing dog food, we can only determine the value of the dog food if we are able to compare the amount of money per bag of food. In addition, knowing how much to purchase depends on large part, on the weight of your pet. The pet with the greater mass will eat more food in comparison with a pet that weighs less.

Getting Ready for Chapter 22

Fill the blanks with words from the box.

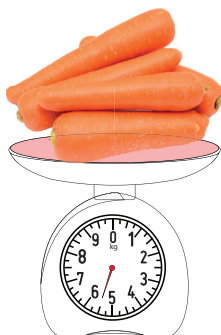
kilogram grams
measuring scale heavier

1. A _____ is used to measure the mass of an object.
2. You can use _____ to measure the weight of a banana.

Choose the most appropriate unit from the box that can be used for measuring the mass of the following objects.

kilogram grams
litres metres

3. 
4. 
5. What is the mass of the carrots?



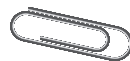
6. Express 3 kg 600 g in grams only.

Estimate Mass

Teaching Point 1:

How do you estimate mass?

The **gram** is the basic unit for measuring **mass**. **Mass** is the amount of matter in an object.



One small paperclip has the mass of about **1 gram**.



1 000 small paperclips will have the mass of about **1 kilogram**.

You can use benchmarks to estimate mass.

1 gram
a small paperclip

1 kilogram
a text book



Estimate the mass of the orange.



The mass of the orange is less than the mass of the text book. So grams is the **appropriate unit** to measure the mass.

Then **estimate** the mass by imagining how many paperclips would have the same mass as the orange.

Activity 1:

Write gram or kilogram to show which is the better unit to measure the mass of each object listed below.

1. whole chicken	2. a cucumber
3. baby	4. box of oranges
5. a key	6. a dog
7. a computer	8. a cell phone

Activity 2:

Write the better estimate for each mass.

1.  10 g 100 g	2.  1 kg 100 g
3.  30 g 300 g	4.  100 g 1 kg
5.  200 g 2 kg	6.  5 kg 500 g

7.  2 kg 20 kg	8.  1 kg 10 kg
9.  400 g 4 000 g	10.  50 kg 500 kg

Activity 3:

Copy and complete using the appropriate metric unit: grams (g) or kilograms (kg).

- The mass of a mango is 200 _____.
- The mass of a baby is 4 _____.
- The mass of a hammer is 1 _____.
- The mass of a cricket ball is 163 _____.
- The mass of a book bag is 10 _____.
- The mass of an envelope 6 _____.
- Name 5 objects in your home that have a mass of less than 1 kilogram?
- Vanna is buying 6 bananas that cost \$1 per kilogram. Is it reasonable to say that the cost of the bananas will be greater than \$6? Explain.
- The weight of a mouse is best measured in what units?

Measure Mass in Grams and Kilograms

Teaching Point 1:

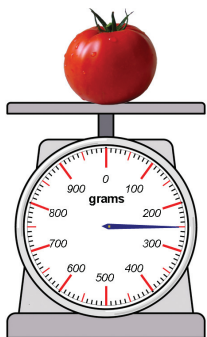
How do you measure and record mass?

Use a Digital Scale



The scale shows that the peanut weighs **2.1 grams**.

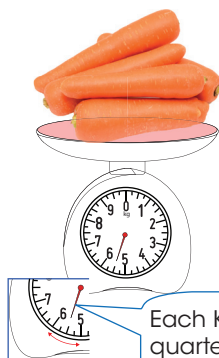
Use an Analogue Scale



The scale shows that the tomato weighs **250 grams**.

This scale measures **grams**.

Use an Analogue Scale



Each Kilogram is divided into quarters, so the mass of the carrots is 5.5 kilograms.

This scale measures **kilograms**.

Activity 1:

Estimate. Then use a digital or an analogue scale to measure and record the mass of the following objects.

1. pencil



2. 10¢ coin



3. raisin



4. base ten cube



5. shoes



6. paper clip



7. tomato



8. lunch bag



9. red bean



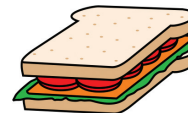
10. banana



11. snack

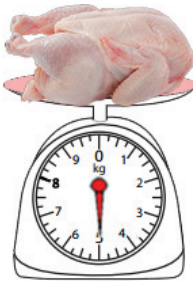
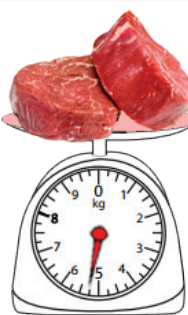
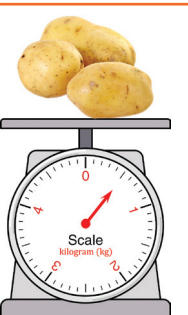
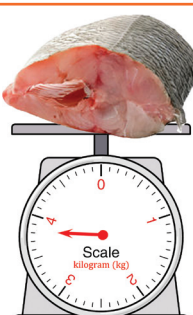
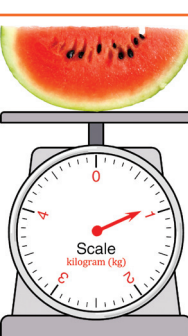
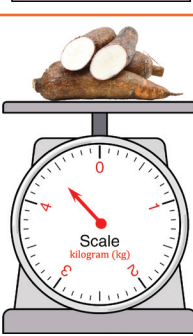


12. sandwich

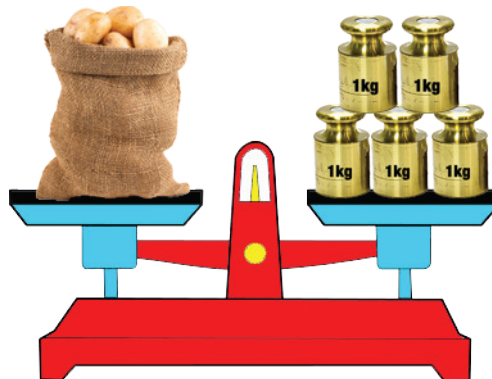


Activity 2:

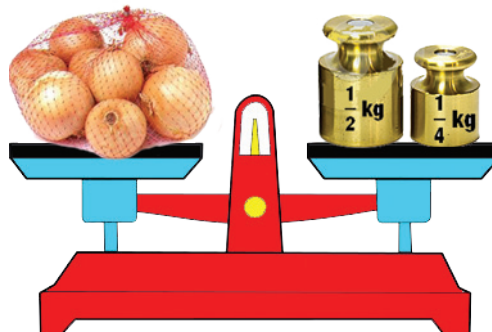
Write the mass for each of the following.

1. 	2. 
3. 	4. 
5. 	6. 
7. 	8. 

9.



10.



Activity 3:

Write the mass of each item to the nearest gram.

1.



2.



3.



4.



5.



6.



7.



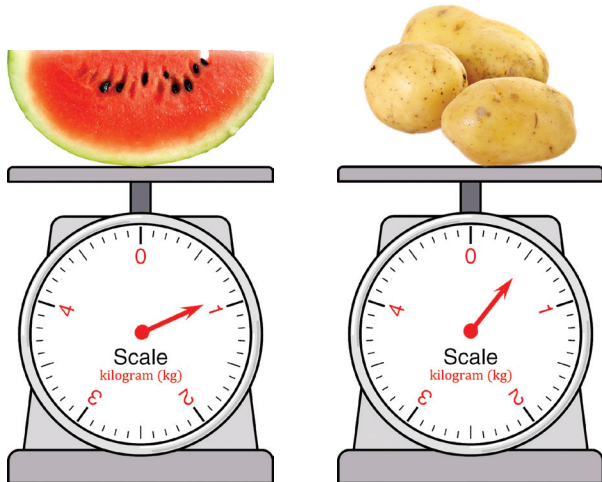
8.



Compare and Order Mass

Teaching Point 1:

How can you compare mass?
Which item is heavier?



The scales show that the slice of watermelon is 900 grams and the potato is 600 grams.

So the slice of watermelon is heavier.

Activity 1:

Use the scales to compare the mass of the following items. Write $<$ or $>$ to compare.

1.



cucumber almonds

2.



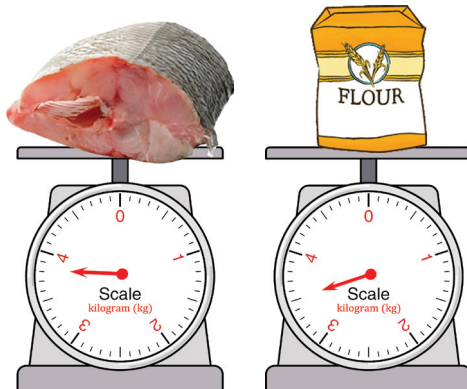
burger patty cupcake

3.



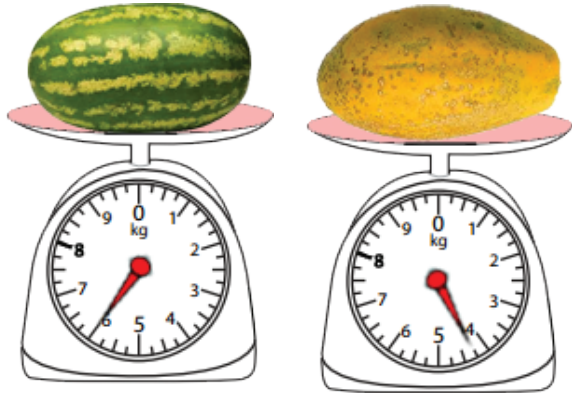
chicken leg garlic

4.



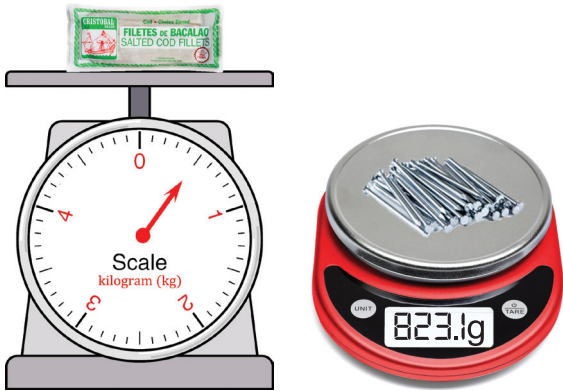
fish flour

5.



watermelon ☐ paw paw

6.



salted fish ☐ nails

7.



tomatoes ☐ sweet potatoes

Activity 2:

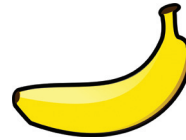
Order each item from lightest to heaviest.

1.

banana

orange

tomato



183 g

262 g

245 g

2.

sandwich

apple

mango



146 g

96 g

198 g

3.

sweet potato

dasheen

eddoes



$\frac{1}{4}$ kg

0.5 kg

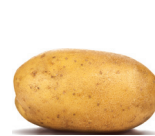
240 g

4.

coconut

potato

avocado



1.4 kg

260 g

566 g

5.

sugar

flour

rice



2 kg

1.5 g

3 000 g

Calculation in Grams

Teaching Point 1:

How can you calculate in kilograms and grams?

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 1 \quad 823 \\ + 3 \quad 697 \\ \hline 9 \quad 520 \end{array}$$

$823 \text{ g} + 697 \text{ g} = 1\,520 \text{ g}$
Regroup 1 520 to kg and g
 $1\,520 \text{ g} \rightarrow 1 \text{ kg } 520 \text{ g}$
 $1 \text{ kg} + 5 \text{ kg} + 3 \text{ kg} = 9 \text{ kg}$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 3 \quad 1120 \\ - 2 \quad 351 \\ \hline 1 \quad 769 \end{array}$$

120 g is less than 351 g
Regroup 1 kg to 1 000 g
 $1\,000 \text{ g} + 120 \text{ g} = 1\,120 \text{ g}$
 $1\,120 \text{ g} - 351 \text{ g} = 769 \text{ g}$
 $3 \text{ kg} - 2 \text{ kg} = 1 \text{ kg}$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 1 \quad 460 \\ \times 4 \\ \hline 5 \quad 840 \end{array}$$

$460 \text{ g} \times 4 = 1\,840 \text{ g}$
Regroup 1 840 g to kg and g
 $1\,840 \text{ g} \rightarrow 1 \text{ kg } 840 \text{ g}$
 $1 \text{ kg} \times 4 = 4 \text{ kg}$
 $4 \text{ kg} + 1 \text{ kg} = 5 \text{ kg}$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 1 \quad 2048 \\ 8 \overline{)2} \quad 48 \\ \hline 256 \end{array}$$

2 is less than 8
Regroup 2 kg to g
 $2 \text{ kg} \rightarrow 2\,000 \text{ g}$
 $2\,000 + 48 \text{ g} = 2\,048 \text{ g}$
 $2\,048 \text{ g} \div 8 = 256 \text{ g}$

Activity 1:

Calculate the following.

1. $40 \text{ g} + 16 \text{ g} =$
2. $390 \text{ g} + 498 \text{ g} =$
3. $297 \text{ g} + 97 \text{ g} =$
4. $5 \text{ g} + 865 \text{ g} =$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 4 \quad 135 \\ 6 \quad 369 \\ + 576 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 4 \quad 677 \\ + 1 \quad 806 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 3 \quad 402 \\ + 1 \quad 789 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 2 \quad 520 \\ 609 \\ + 4 \quad 273 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 3 \quad 900 \\ 7 \quad 88 \\ + 9 \quad 35 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 571 \\ + 1 \quad 659 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 10 \quad 15 \\ + 3 \quad 990 \\ \hline \end{array}$$

$$\begin{array}{r} \text{kg} \quad \text{g} \\ 5 \\ 6 \quad 69 \\ + 941 \\ \hline \end{array}$$

13. $7 \text{ kg } 32 \text{ g} + 4 \text{ kg } 865 \text{ g} =$

14. $5 \text{ kg } 470 \text{ g} + 734 \text{ g} =$

15. $1 \text{ kg } 58 \text{ g} + 8 \text{ kg } 642 \text{ g} + 705 \text{ g} =$

16. $2.9 \text{ kg} + 4.5 \text{ kg} + 0.4 \text{ kg} =$

17. $1.6 \text{ kg} + 0.76 \text{ kg} + 0.69 \text{ kg} =$

Activity 2:

Calculate the following.

1. $45 \text{ g} - 18 \text{ g} =$
2. $100 \text{ g} - 17 \text{ g} =$
3. $320 \text{ g} - 248 \text{ g} =$
4. $474 \text{ g} - 368 \text{ g} =$

$$\begin{array}{r} \text{5.} \quad \text{kg} \quad \text{g} \\ 2 \quad 345 \\ - 1 \quad 806 \\ \hline \end{array}$$

$$\begin{array}{r} \text{6.} \quad \text{kg} \quad \text{g} \\ 6 \quad 98 \\ - 4 \quad 183 \\ \hline \end{array}$$

$$\begin{array}{r} \text{7.} \quad \text{kg} \quad \text{g} \\ 3 \quad 10 \\ - \quad 57 \\ \hline \end{array}$$

$$\begin{array}{r} \text{8.} \quad \text{kg} \quad \text{g} \\ 10 \quad 120 \\ - 5 \quad 615 \\ \hline \end{array}$$

$$\begin{array}{r} \text{9.} \quad \text{kg} \quad \text{g} \\ 4 \quad 67 \\ - 1 \quad 69 \\ \hline \end{array}$$

$$\begin{array}{r} \text{10.} \quad \text{kg} \quad \text{g} \\ 12 \quad 10 \\ - \quad 26 \\ \hline \end{array}$$

$$\begin{array}{r} \text{11.} \quad \text{kg} \quad \text{g} \\ 3 \quad 304 \\ - 1 \quad 579 \\ \hline \end{array}$$

$$\begin{array}{r} \text{12.} \quad \text{kg} \quad \text{g} \\ 9 \quad 7 \\ - 6 \quad 19 \\ \hline \end{array}$$

13. $4 \text{ kg } 89 \text{ g} - 375 \text{ g} =$

14. $1 \text{ kg} - 34 \text{ g} =$

15. $6 \text{ kg } 100 \text{ g} - 4 \text{ kg } 673 \text{ g} =$

16. $4.5 \text{ kg} - 3.6 \text{ kg} =$

17. $0.9 \text{ kg} - 456 \text{ g} =$

18. $1.07 \text{ kg} - 0.75 \text{ kg} =$

Activity 3:

Calculate the following.

1. $35 \text{ g} \times 2 =$

2. $650 \text{ g} \times 4 =$

$$\begin{array}{r} \text{3.} \quad \text{kg} \quad \text{g} \\ 3 \quad 17 \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{4.} \quad \text{kg} \quad \text{g} \\ 4 \quad 200 \\ \times \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} \text{5.} \quad \text{kg} \quad \text{g} \\ 2 \quad 28 \\ \times \quad 15 \\ \hline \end{array}$$

$$\begin{array}{r} \text{6.} \quad \text{kg} \quad \text{g} \\ 1 \quad 146 \\ \times \quad 8 \\ \hline \end{array}$$

$$\begin{array}{r} \text{7.} \quad \text{kg} \quad \text{g} \\ 3 \quad 17 \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{8.} \quad \text{kg} \quad \text{g} \\ 10 \quad 321 \\ \times \quad 10 \\ \hline \end{array}$$

$$\begin{array}{r} \text{9.} \quad \text{kg} \quad \text{g} \\ 5 \quad 49 \\ \times \quad 24 \\ \hline \end{array}$$

$$\begin{array}{r} \text{10.} \quad \text{kg} \quad \text{g} \\ 2 \quad 601 \\ \times \quad 13 \\ \hline \end{array}$$

11. $2 \text{ kg } 62 \text{ g} \times 6 =$ 12. $1 \text{ kg } 234 \text{ g} \times 9 =$

13. $12 \text{ kg } 507 \text{ g} \times 8 =$ 14. $1 \text{ kg } 77 \text{ g} \times 14 =$

15. $15 \text{ kg} \times 3.45 =$ 16. $15.3 \text{ kg} \times 1.5 =$

Activity 4:

Calculate the following.

1. $69 \text{ g} \div 3 =$

2. $495 \text{ g} \div 15 =$

3. $408 \text{ g} \div 12 =$

4. $264 \text{ g} \div 24 =$

$$\begin{array}{r} \text{5.} \quad \text{kg} \quad \text{g} \\ 5 \overline{)12 \quad 15} \end{array}$$

$$\begin{array}{r} \text{6.} \quad \text{kg} \quad \text{g} \\ 7 \overline{)48 \quad 6} \end{array}$$

$$\begin{array}{r} \text{7.} \quad \text{kg} \quad \text{g} \\ 14 \overline{)30 \quad 44} \end{array}$$

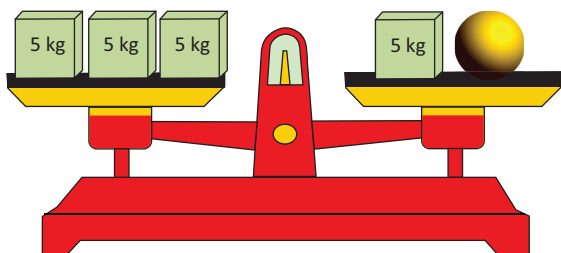
$$\begin{array}{r} \text{8.} \quad \text{kg} \quad \text{g} \\ 20 \overline{)1 \quad 600} \end{array}$$

Calculate Unknown Mass on a Balance

Teaching Point 1:

How can you determine the mass of the unknown?

What is the mass of the sphere?



The scale is balanced. So the mass on each side of the scale is equal.

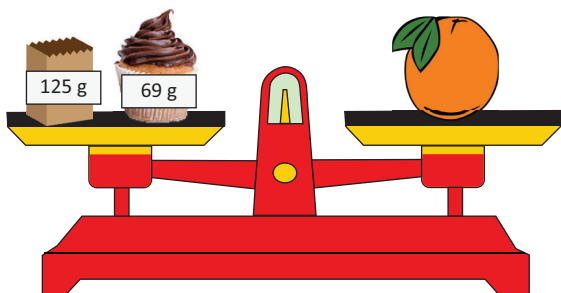
1 cube weighs 5 kg.

The sphere weighs as much as 2 cubes.

The sphere $\rightarrow 5 \text{ kg} \times 2 = 10 \text{ kg}$

So, the mass of the sphere is 10 kg.

What is the mass of the orange?



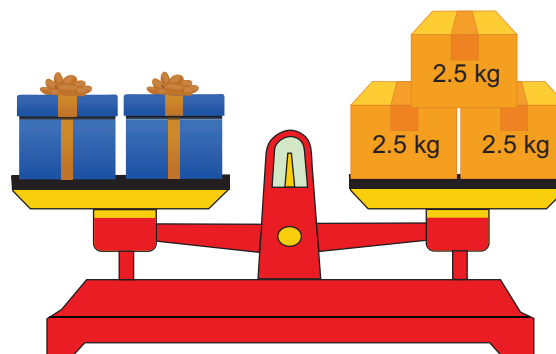
The mass on both sides of the scale is equal.

The orange weighs:
 $125 \text{ g} + 69 \text{ g} = 194 \text{ g}$

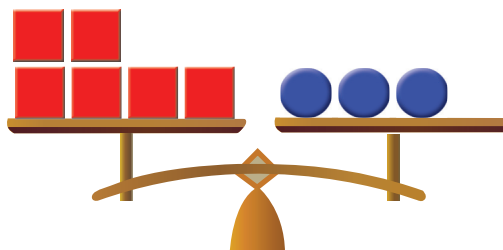
Activity 1:

Calculate the unknown weight to balance each scale.

1. If each gift box has the same mass, what is the mass of one gift box?

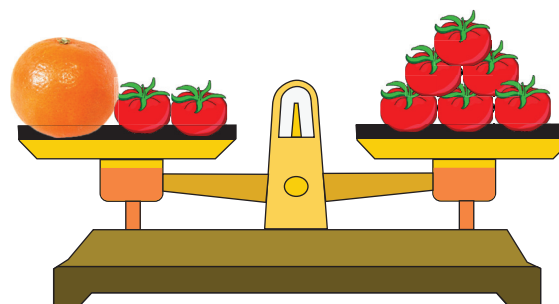


2. On the equal arm balance shown below, one ● is 30 grams.



What is the weight of one ■ ?

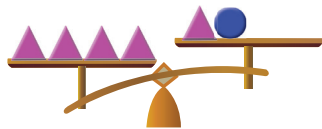
3. The scale below is balanced. Each tomato weighs exactly 90 grams.



What is the mass of the grapefruit?

Solve Problems in Measurement

4. Teanna has a box with 198 g of cereal and Maria has a box with 0.25 kg of cereal. Who has more cereal?
5. A chicken and a turkey together weigh 6 kilograms. The turkey alone weighs 4 kilograms 267 grams. Calculate the weight of the chicken.
6. Mother buys 5 kilograms of fish which costs \$23.50 per kilogram. How much did she pay for the fish?
7. If  = 30 grams and  = 15 grams, how many of the triangles should be removed from the left side for the scale to balance?



8. Six bags of cucumbers each weighing 0.75 kilograms are bought at the grocery.
 - (a) What is the total mass of the cucumbers?
 - (b) The cucumbers are cut up and shared equally into 10 salad bowls. What is the mass of cucumbers in each bowl?
9. A baker used 9.75 kg of flour to make bread and $3\frac{1}{2}$ kg to make cakes. How much flour is left from a 20 kg bag of flour?
10. The mass of 20 packs of chocolate chip cookies is 960 grams. If there are 4 cookies in a pack, what is the mass of one cookie?
11. The total mass of a bag of mangoes and plums is 1.5 kg. Each plum has

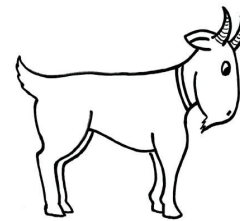
a mass of 5 grams and each mango has a mass of 120 grams. The bag contains 60 plums.

- (a) What is the total mass of the plums?
 - (b) How many mangoes are in the bag?
12. Mother used 0.5 kg of cheese to make a macaroni pie and 8 cheese sandwiches. She put 12 grams of cheese in each sandwich. How much cheese did she use in the pie?

Chapter Review

Answer the questions.

1. What is the most suitable unit for measuring the mass of a goat.



$$\begin{array}{r} \text{kg} \quad \text{g} \\ 4 \quad 25 \\ \times \quad 8 \\ \hline \end{array}$$

3. Which of the two fruits below has the greater mass?

coconut



2.25 kg

breadfruit



2 005 g

4. A man bought a pumpkin and a watermelon as shown below.



8.25 kg



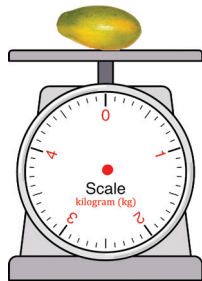
3.5 kg

How much heavier is the watermelon than the pumpkin?

5. Write $>$ or $<$ in the box below.

1.5 kg 1 345 g

6. Draw the pointer on the scale below to show that the paw paw weighs 2.8 kilogram.

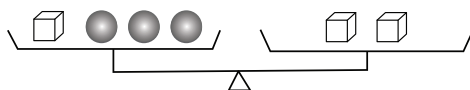


7. Maria went on a vacation with the bags shown below.



Calculate the total mass of the bags.

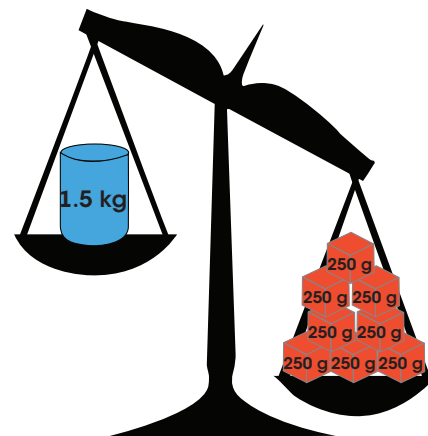
8. The diagram below shows a balanced scale with some cubes and some balls.



Each cube weighs 9 grams. What is the mass of one ball?



9. How many bags of rice each weighing 250 g can you get from a bag of rice weighing 3 kilograms?
10. Barry has 10 kilograms of peppers. He makes bottles of seasoning with 2 kg 500 g of the pepper and packages 5 kg 890 g to sell at the market.
- (a) What is the total mass of peppers that Barry uses altogether?
- (b) What mass of peppers remains?
- (c) If Barry uses $\frac{1}{4}$ kg of peppers in each bottle of seasoning, how many bottles of seasoning can he make with the remaining peppers?
11. In the diagram below, the cylinder weighs 1.5 kilogram and each cube weighs 250 grams.



How many cubes must be removed from the scale pan to balance the scale?