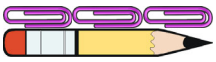
Contents

Measuring Length 1

We measure things to find how long or how wide they are, as compared to other things. For all measuring, we need a **measuring unit**. We repeat the measuring unit many times, and compare it to the thing we are measuring.

1. **Activity.** Measure how long some things are, using a paperclip as a measuring unit.

You need: Several paperclips that are the same size. Small things to measure, such as an eraser, pencils, crayons, toys, and books.
The objects being measured should ideally be spanned by a whole number of length units (with no gaps or overlaps).



But if an object is not exactly a whole number of paperclips, say that the thing is *about* so many paperclips long.

Measure the length of five things with paperclips:

_____ _____ paper clips

_____ _____ paper clips

_____ _____ paper clips

_____ _____ paper clips

_____ _____ paper clips

2. **Activity.** This time we will use a crayon or pencil as a measuring unit.

You need: Several crayons or pencils that are the same length. Objects to measure, such as books, kitchen utensils, toys, etc. The objects being measured should ideally be spanned by a whole number of length units (with no gaps or overlaps).

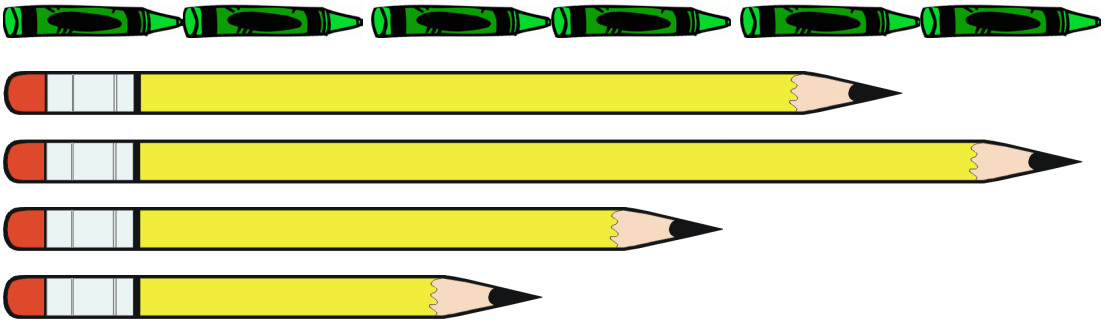
Measure the length of three things with crayons (or pencils):

_____ _____ crayons

_____ _____ crayons

_____ _____ crayons

3. How many crayons long are these pencils?



a. _____ crayons long

b. _____ crayons long

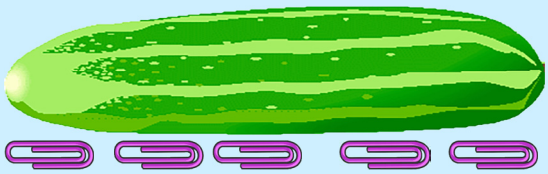
c. _____ crayons long

d. _____ crayons long

4. Sarah measured the length of this cucumber using paperclips.

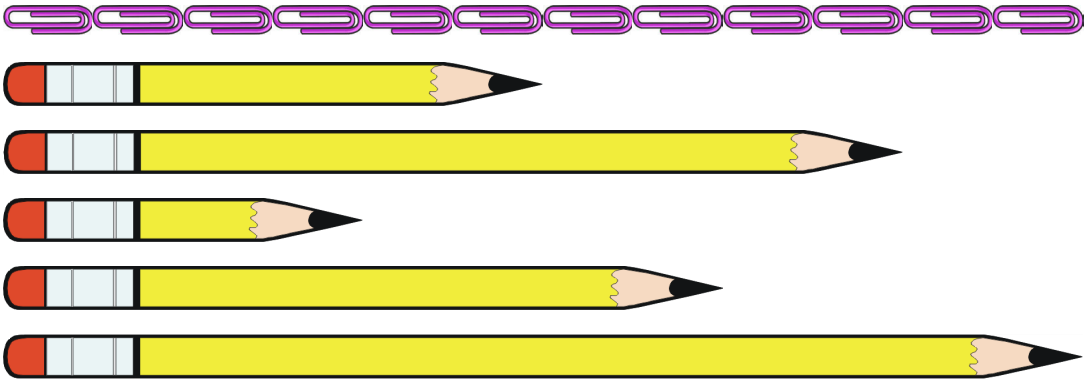
Do you agree with her result?

Why or why not?



"It is 5 paperclips long."

5. How many paper clips long are the pencils?



a. _____ paper clips long

b. _____ paper clips long

c. _____ paper clips long

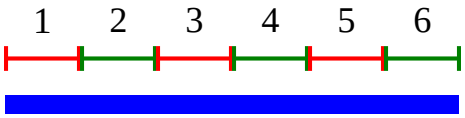
d. _____ paper clips long

e. _____ paper clips long

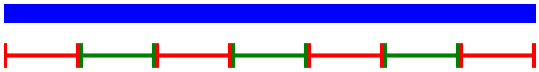
Measuring to the Nearest Centimeter

Remember? We can measure how long things are using *centimeters*.

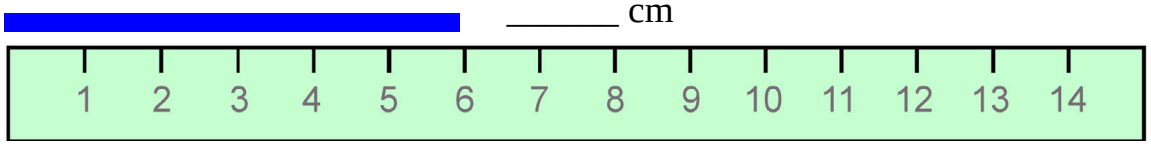
This line is 1 centimeter long: 
A centimeter is written in short form as "cm."
The blue line on the right is 6 cm long. →



1. How many centimeters long are these lines?

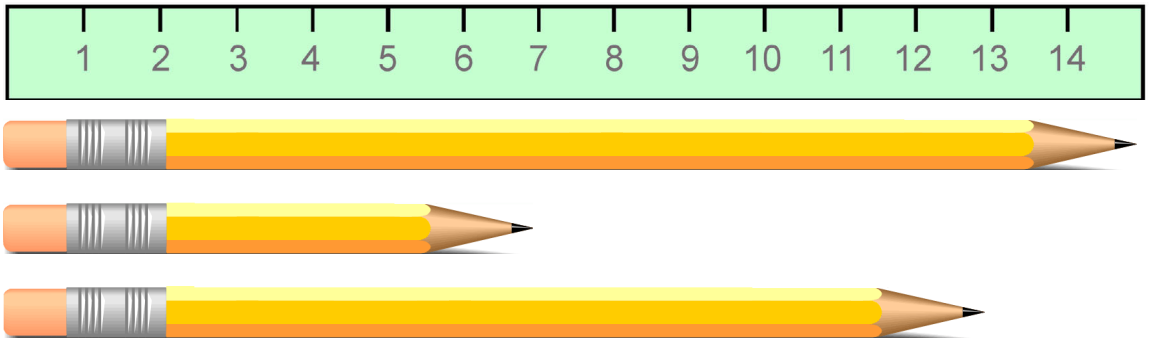
a.  _____ cm

b.  _____ cm

c.  _____ cm

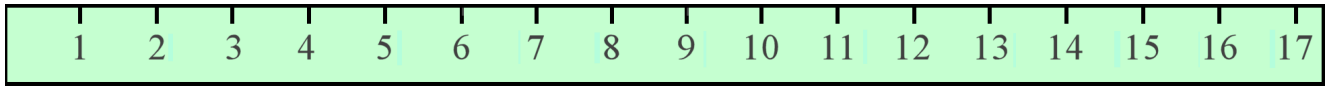
d.  _____ cm

2. Measure the pencils with a centimeter ruler. If you don't have one, you can cut out the one from the bottom of this page. Then answer the questions.



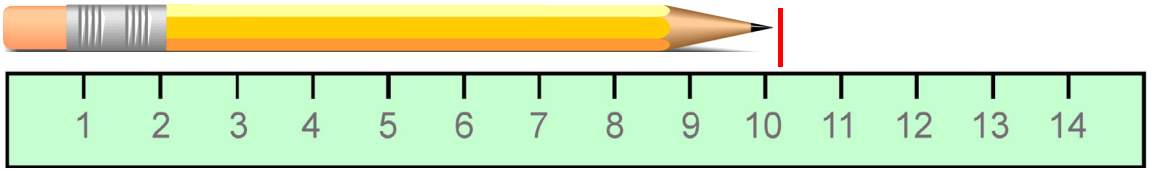
a. How much longer is pencil #1 than pencil #2? _____ cm

b. How much longer is pencil #3 than pencil #2? _____ cm

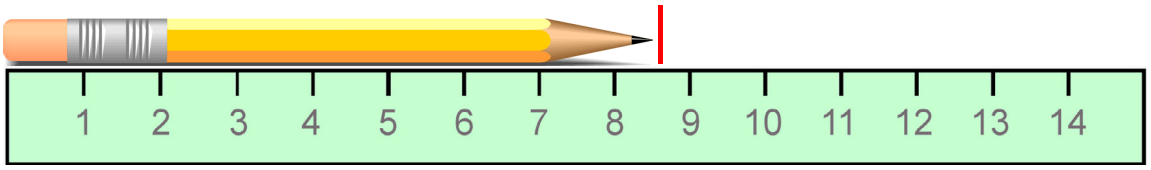


Most things are NOT exactly a certain number of whole centimeters.
You can measure them to the nearest centimeter.

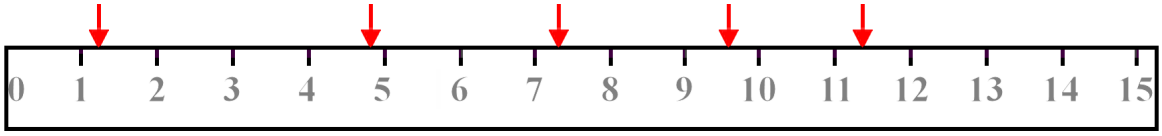
The pencil below is a little over 10 cm long. It is *about 10* cm long.



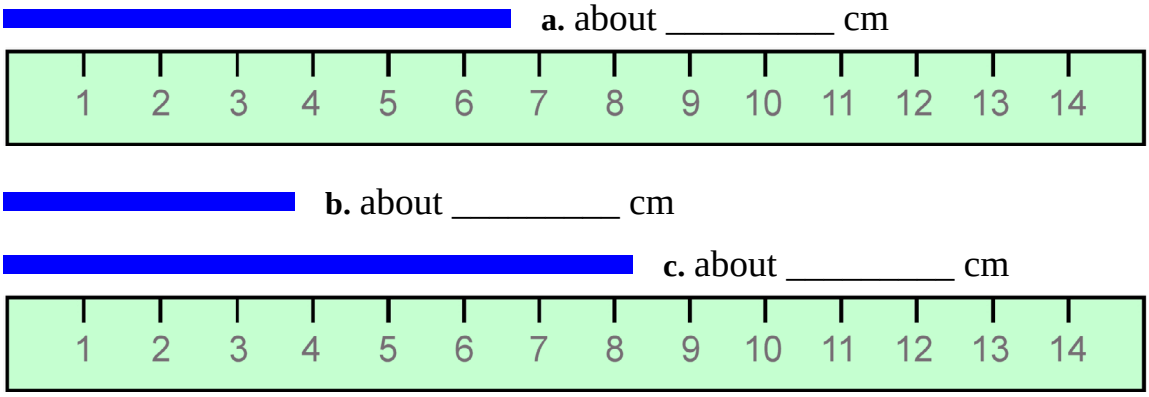
This pencil is about 9 cm long. The end of the pencil is closer to 9 cm than to 8 cm.



3. Circle the number that is nearest to each arrow.



4. Measure the lines to the nearest centimeter.



5. This line is 1 cm long: ⊢—⊣ . Your finger is probably about that wide; put it on top of the 1-cm line and check! Guess how long these lines are. Then measure.

	My guess:	**Measurement:**
a. ———————————	about _____ cm	about _____ cm
b. ————	about _____ cm	about _____ cm
c. ———————	about _____ cm	about _____ cm

6. **a.** Find two small objects. Measure to find *about* how many centimeters longer one is than the other.

   The _____ is *about* _____ cm longer

   than the _____.

   b. Find other two small objects. Measure to find *about* how many centimeters longer one is than the other.

   The _____ is *about* _____ cm longer

   than the _____.

7. Draw some lines here or on blank paper. Use a ruler. Hold the ruler down tight with one hand, while drawing the line with the other. It takes some practice!

   a. 6 cm long

   b. 3 cm long

   c. 12 cm long

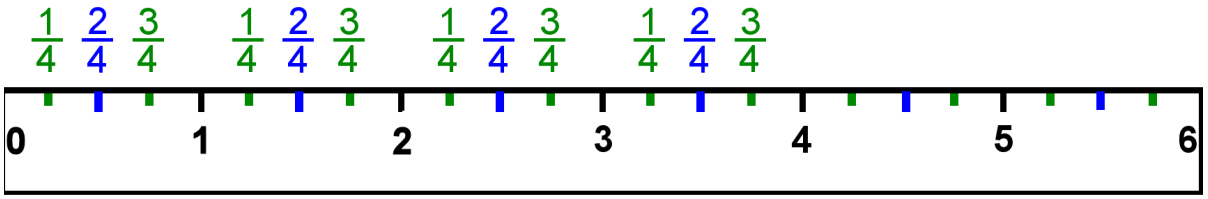
   d. 17 cm long

8. Find some small objects. First GUESS how long or tall they are. Then measure. If the item is not exactly so-many centimeters long, then measure it to the nearest centimeter and write "about" before the centimeter-amount, such as *about 8 cm.*

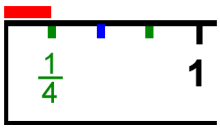
Item	GUESS	MEASUREMENT
	cm	cm
	cm	cm
	cm	cm
	cm	cm
	cm	cm

Measuring to the Nearest Fourth-Inch

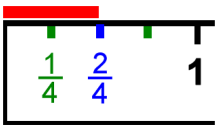
This ruler measures in inches. You can see three lines between each two numbers on the ruler. Those three lines divide each inch *into four parts*. The parts are *fourth parts* or *quarters* of an inch. We have marked those quarters with fractions.



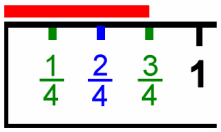
The 2/4 mark is also the 1/2 mark. We normally use 1/2 instead of 2/4.



This line is 1/4 of an inch long.

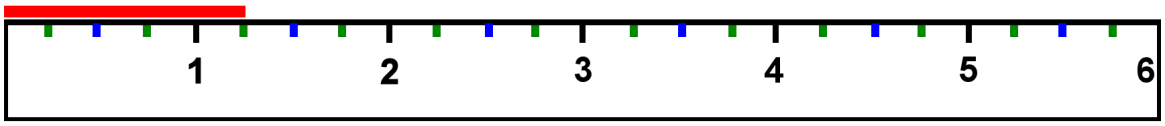


This line is two quarters of an inch long. It is also a half inch long.

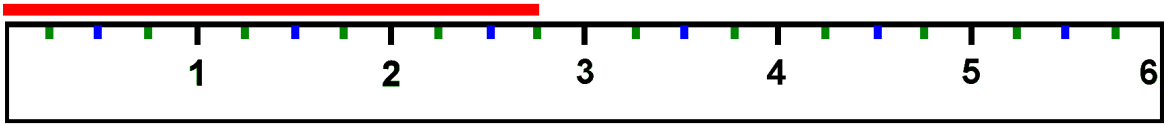


This line is 3/4 of an inch long.

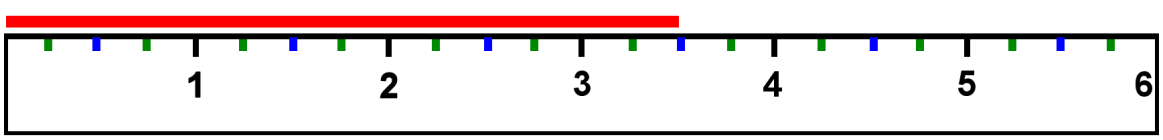
If a line reaches to the 1/4-inch mark after the number 1, the line is 1 inch *and* 1/4 inches long. But when writing it, we omit the "and" and write: The line is 1 1/4 inches long.



If a line reaches the 3/4-inch mark after the number 2, then the line is 2 inches *and* 3/4 inch long, but we write it as 2 3/4 inches long.

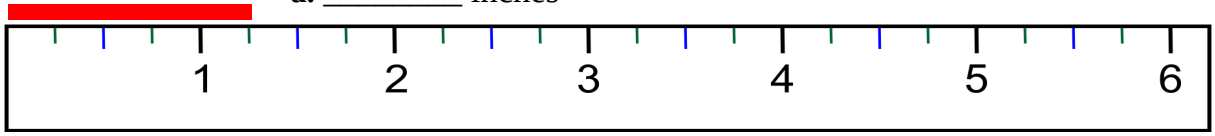


This line is 3 1/2 inches long.

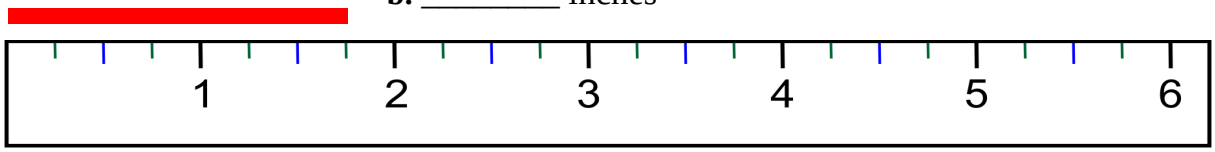


1. Measure the lines using the ruler.

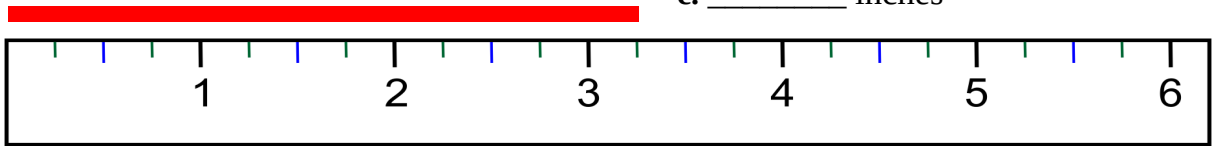
a. _____ inches



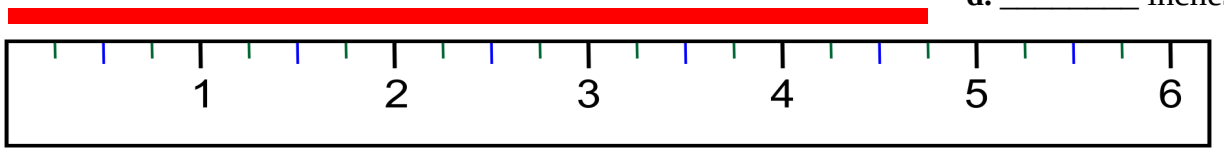
b. _____ inches



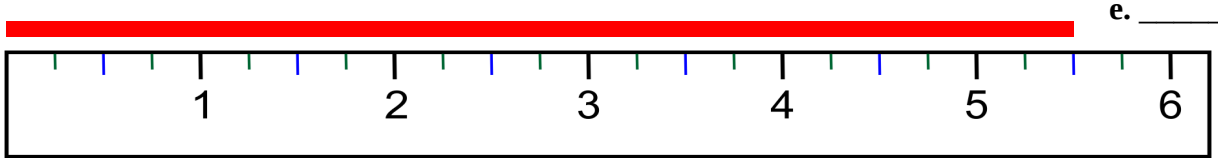
c. _____ inches



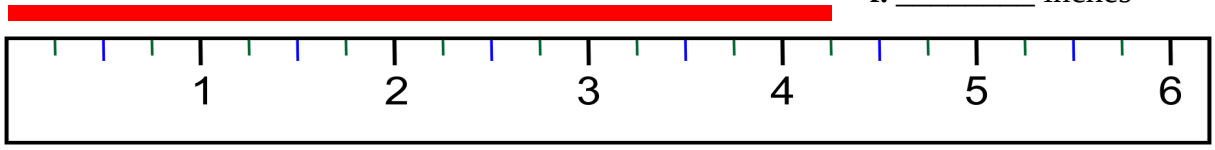
d. _____ inches



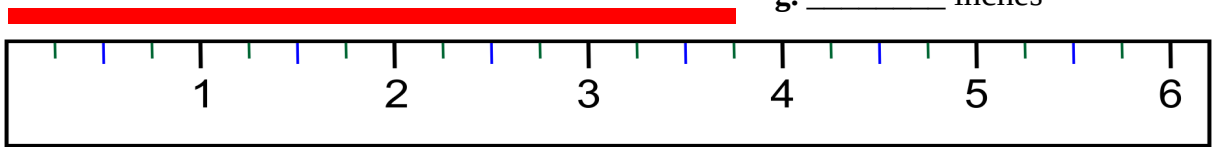
e. _____ in.



f. _____ inches



g. _____ inches



2. Draw lines using a ruler. Your own ruler may have many more little lines between the whole-inch marks. If you find your own ruler confusing, you can cut out one of the rulers from the previous pages, and use that. Glue it on cardboard, or tape it on top of your ruler.

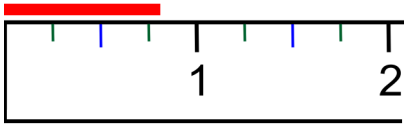
a. 4 1/2 inches long

b. 2 1/4 inches long

c. 5 1/4 inches long

d. 4 3/4 inches long

This line is not exactly 3/4 inch long, nor exactly 1 inch long, but its length is between those two. The endpoint of the line is closer to the 3/4-inch mark than it is to the 1-inch mark. We say the line is *about* 3/4 of an inch long, or *approximately* 3/4 of an inch long.



3. Measure items using the ruler that has the 1/4, 1/2, and 3/4-inch marks (quarters of an inch). If the item is not exactly as long as the markers on the ruler show, choose the nearest mark as the length, and write "about 5 1/4 inches," etc.

Item	Length

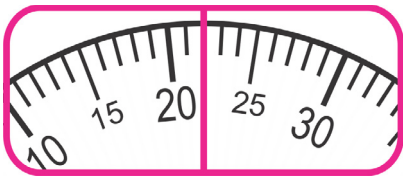
Weight in Kilograms

Weight means *how heavy* something is. You can measure weight using *a scale*.
A bathroom scale measures weight in *kilograms* (abbreviated kg).

The scale usually has short lines for each kilogram increment, and long lines for each 10 kilograms. In the picture below, the in-between numbers ending in "5" are marked with the number 5.

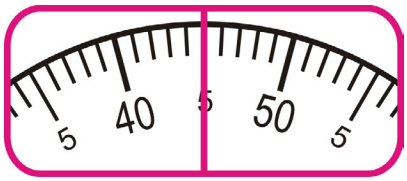
In this lesson, you need to use a bathroom scale that measures weight in kilograms. You will also need

- a bucket and water
- encyclopedias or some other fairly heavy books
- a plastic bag or some other bag
- a backpack

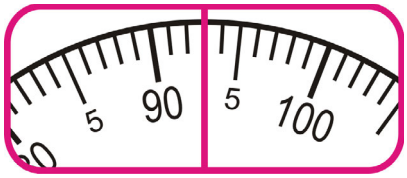


The scale is showing 22 kg.

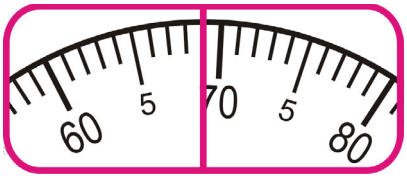
1. How many kilograms is the scale showing?



a. _____



b. _____



c. _____

2. Step onto the scale. How much do you weigh? _____ kg

3. Find out how many kilograms your family members weigh. Write a list below.

_____ _____ kg _____ _____ kg

_____ _____ kg _____ _____ kg

_____ _____ kg _____ _____ kg

4. Also, weigh some of your family members together.

_____ and _____ together weigh _____ kg.

_____ and _____ together weigh _____ kg.

5. Now weigh some other items with the bathroom scale. Note: you cannot weigh very light items on it. You also cannot weigh very big and bulky items (such as tables) on it because you can't place them fully on the scale. Try to find objects that are not very big.

a bucket full of water	_____ kg	Mom's frying pan	_____ kg
a bucket half full of water	_____ kg	_____	_____ kg
a stack of heavy books	_____ kg	_____	_____ kg

6. Find out how many kilograms of water you can carry. Can you carry the bucket when it is full? If not, pour out some water until you can carry the bucket.

   I can carry a bucket of water that weighs _____ kg.

7. **a.** Find out how many kilograms of books you can carry in a bag. Fill the bag with books and weigh it. Can you carry it? If not, take out some books until you are able to carry the bag.

   I can carry a bagful of books that weighs _____ kg.

b. The same as above, but use a backpack.

   I can carry a backpack that weighs _____ kg.

c. Weigh yourself with and without the heavy bag of books.

I weigh _____ kg. I weigh _____ kg with the heavy bag.

What is the difference? _____ kg.

You can use this method to weigh items that cannot easily be placed on the scales, but that you can hold.

d. Weigh yourself with and without a heavy book.

I weigh _____ kg. I weigh _____ kg with the heavy book.

What is the difference? _____ kg. So, the book weighs _____ kg.

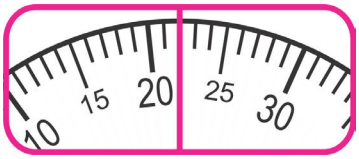
Grams and Kilograms

We can measure objects using different types of scales, to find out how heavy they are.

In this lesson we will use scales that show kilograms (kg) and grams (g). Those are units for mass. The **mass** of an object means how much material (or substance or "stuff") is in it. And the more material is in it, the heavier it is!

- A **gram** (abbreviated "g") is a very small unit of mass. One large paperclip has a mass of about 1 gram.
- A **kilogram** (kg) is a larger unit of mass. For example, a baby might have a mass of 4 kg. A liter (or a quart) bottle of water has a mass of 1 kg.
- A thousand grams make one kilogram: 1,000 g = 1 kg.

In this lesson, you will need:



- A bathroom scale that measures in kilograms. An analog scale is great; digital is fine.
- A kitchen scale that measures in grams. An analog scale is great; digital is fine, too.
- Paperclips, thumbtacks, pencils, and other small objects.
- A book, water bottle, or other object with a mass of (approximately) 1 kg.
- An object with a mass of 100 g (a small apple, tomato, or a potato will do).
- Objects to weigh.

1. Let's weigh stuff!

a. How many paperclips do you need to make the scale show 10 grams? Use both small and large paperclips if you have them.

Note: one paperclip may not make a scale to show anything, because it may be less than one gram. (Small paperclips are about 1/4 to 1/3 of a gram.)

b. Place 20 paperclips on the scale. Then do the same with 20 thumbtacks. Which is heavier, *one* paperclip or *one* thumbtack?

c. Estimate (make a guess) the mass of a ruler and a pencil. Then check with the scale.

(Note to the teacher: Technically speaking, scales measure weight, not mass. Weight of an object is a force; it is how much gravity pulls on an object. Scales measure the pull of gravity on an object. But, scales we will be using here do not show a measurement of force (which would be in Newtons) but use kilograms or grams which are units of mass. In other words, the scales use gravity to indirectly measure an object's mass. In this lesson, it is alright to use the word "weight" since that is common in everyday usage, and since that is what scales in reality do measure. However, it is also good to get students used to the word and idea of "mass".)

2. Use a kitchen scale and find:

   a. an object with a mass of 50 grams;

   b. an object with a mass of 100 grams;

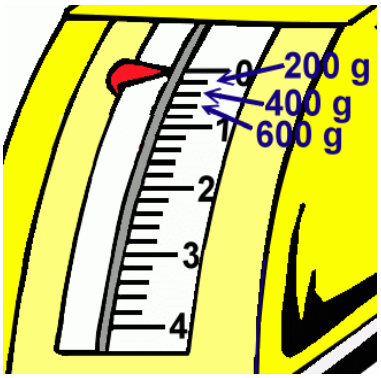
   c. a book or another object with a mass of 1,000 grams (1 kilogram).

3. Estimate (in grams) the mass of various small items your teacher presents to you. Then check their mass using a kitchen scale.

Item	Estimated mass	Mass
	_____ g	_____ g

4. Now use a bathroom scale that measures in kilograms. Estimate the mass of various things and people. Then check their mass using the bathroom scale.

Thing/person	Estimated mass	Mass
	_____ kg	_____ kg

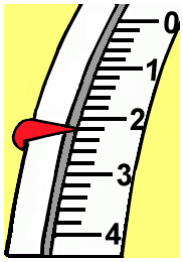


The numbers 0, 1, 2, 3, and 4 on this kitchen scale refer to whole kilograms. In between each two numbers there are <u>four little lines</u>. They divide each kilogram into *five* parts.

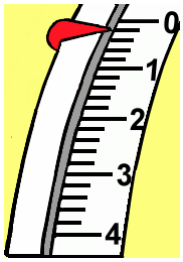
This means that each little line marks a 200-gram increment. (200 g + 200 g + 200 g + 200 g + 200 g = 1,000 g = 1 kg.)

The first little line after the 0-kg mark means 200 g. Each time, one little line more means 200 g more.

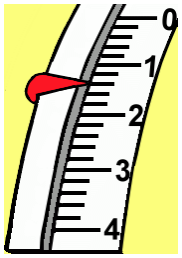
5. Write the amount of kilograms and grams that the scales are showing.



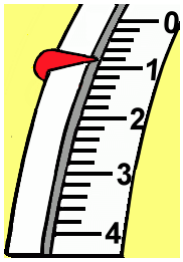
a. *2* kg *200* g



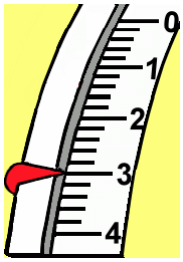
b. _____ kg _____ g



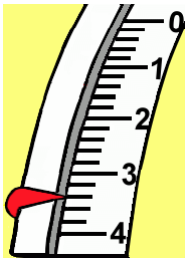
c. _____ kg _____ g



d. _____ kg _____ g



e. _____ kg _____ g



f. _____ kg _____ g

6. Amy read on a can of beans that its net weight was 415 grams. Yet, when she put it on the scale, it showed 481 g.

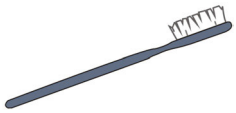
a. What is the difference between the two masses?

b. Why is there a difference?

c. How many cans will Amy need to have at least 1 kg of beans?

7. Shaun put eight identical crayons on a scale and the scale showed 41 grams. <u>*About*</u> how much is the mass of one crayon?

8. Which is the best estimate of how much each thing weighs?

a.  500 g 5 g	**b.**  70 kg 7 kg	**c.**  1 kg 200 g	**d.**  1 kg 150 g
e.  30 g 300 g	**f.** eyeglasses 35 g 300 g	**g.** A car 100 kg 2,000 kg	**h.** an apple 1 kg 100 g
i. A bucket full of water 10 kg 50 kg	**j.** A spoonful of sand 10 g 100 g	**k.** a baby 500 g 5 kg	**l.** flashlight 300 g 2,000 g

9. Match the things and their masses.

An adult woman	55 kg
A puppy	1 kg
A pencil	500 g
A school book	25 kg
A magazine	50 g
A 9-year-old boy	150 g

10. Fill in the blanks with a reasonable unit (either g or kg).

a. Mom got a 3-_____ package in the mail. It had books in it.

b. Jane got a 300-_____ package in the mail. It had a puzzle in it.

c. Mark's dog is 30 _____.

d. A cell phone is 300 _____.

e. Mary bought 3 _____ of strawberries at the marketplace.

f. Audrey steps on a scale, and it shows 60 _____ .

g. The teddy bear is 250 _____.