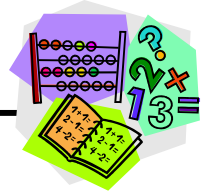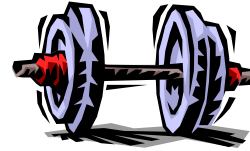# Mass

The circular plates on either end of the bar have been calibrated (measured) to a specific mass (e.g., 10 lbs.).

Mass is the amount of material or matter in an object.

Mass should not to be confused with weight, although in everyday life the word "weight" is often used when referring to mass.

Weight is a measurement of how gravity affects mass. Weight changes as the force of gravity changes.

Mass does not change from place to place.

For example, the moon is approximately $\frac{1}{5}$ the mass of the Earth. The weight of an object on the moon would be about $\frac{1}{5}$ of the weight of the same object on Earth, because the gravitational pull on the moon is less.

The mass (amount of matter) is the same on the moon as on Earth.

Mass is measured using the SI base unit called **grams** (g). The SI terms for mass are:

Mass Staircase

1000 g kilograms (kg)
100 g hectograms (hg)
10 g decagrams (dag)
1 g grams (g)
1/10 g decigrams (dg)
1/100 g centigrams (cg)
1/1000 g milligrams (mg)

1 tonne (t) = 1000 kg or 1 000 000 g

Hint: Remember to use this ACRONYM to help you with the order of the units:
King
Henry's
Daughter
Betty
Detested
Counting

Kilograms, grams and tonnes are commonly used units for measuring mass.

Ingredients in medication are measured and listed in milligrams (**mg**).

Cereal ingredients are measured and listed in grams (**g**).

Tractor-trailer vehicles often carry loads measured in tonnes (**t**).

Converting Between g, kg and t

Shippers at factories that produce many types of products convert between different units of mass when loading products onto trucks.

Examples

Check these out! Use the mass staircase or move the decimal to convert.

A) How many mg does 25 g represent?   25 000 mg
   g to **mg** is 3 steps down
   1 g = 10 × 10 × 10 = 1000 mg
   25 g = 25 000 mg

B) How many kg does 1200 g represent? 1.2 kg
   g to **kg** is 3 steps up
   1 2 0 0 = 1.2 kg

C) How many tonnes does 16 900 kg represent? 16.9 t
   kg to **t** is steps up
   3 steps are 10 × 10 × 10 = 1000
   16 900 kg ÷ 1000 (3 steps) = 16.9 t

D) How many g does 2 t represent? 2 000 000 g
   t to **g** is 6 steps down
   2 0 0 0 0 0 0 0 = 2 000 000 g

Measuring Mass

Truck drivers must keep track of the mass of their vehicles and their loads. Carrying too much mass can damage roads and the vehicle's suspension, and cost the driver in fines at vehicle weigh stations located along highways.

Small amounts of mass can be measured using a **balance scale**.

A **balance scale** is a device that has two pans or trays with a balance point (fulcrum) in the middle.

To measure the mass of an object, the object is placed on one pan and **standard masses** are placed on the other pan until the pans *balance* each other. The mass of the object is the sum of the standard masses on the other pan.

A **standard mass** is an object that has been tested and certified to accurately represent the value stated on the mass.
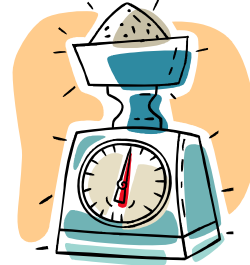
New digital balance scales allow objects to be measured without having to use and calculate the sum of standard masses.

Did You Know?

Most commonly used scales at home measure **weight** (the gravitational pull) and use grams (g) or kilograms (kg). Check out these examples.

Think About …

What types of equipment are used to measure mass in your community and in the workplace?

What types of units are used?

Think about farms, mail outlets, construction sites and grocery stores.

Practice: Estimating and Measuring Mass

1. Using a balance scale, estimate and then measure the masses of the following items and four other items of your choice. Be sure to include the units of measurement.

Item	Estimated Mass	Actual Mass
Piece of chalk		
Pencil		
Shoe		
Can of pop		
Stapler		
Hole punch		

2. Check out the science lab to examine standard masses. Locate a balance scale and record the masses of a variety of objects.

Practice: Converting Between g, kg and t

1. Use the mass staircase, move the decimal or use other strategies to complete the following metric conversions.

tonnes (t)		kilograms (kg)		grams (g)
1	=		=	
	=	1	=	
	=		=	25 000 000
	=	400	=	
10	=		=	
	=		=	10
	=	7000	=	
3	=		=	
	=		=	650 000

2. Sami has a job at a truck weigh scale station for the summer. One of Sami's tasks is to calculate the total mass of trucks coming through the station and record them in tonnes. The first three semis of the day have masses of 12 300 kg, 9460 kg and 10 350 kg. What is the total mass, in tonnes, of the first three trucks of the day?

Solving Mass Problems

Examples

A) The cement truck is carrying 2500 kg of cement.

If a wheelbarrow can carry approximately 150 kg of cement per load, how many loads will the worker need to empty the cement truck?

Solution:

| 2500 kg | ÷ | 150 kg/load | = | 16.666… | = | **17 loads** |

| Amount of cement in the cement truck | Amount of cement in each wheelbarrow load | More than 16 wheelbarrow loads of cement needed | Rounding up to 17 loads allows for the removal of all the cement from the cement truck |

The worker will need to take **17 loads** of cement from the cement truck to empty the truck.

B) A large dump truck can hold 3400 kg of household garbage. If the average household has 19.4 kg of garbage on pick-up day, how many households' worth of garbage could this truck pick up?

Solution: 3400 ÷ 19.4 = 175.26
The truck could pick up the garbage from 175 households.
(0.26 represents part of a load, but not an entire household)

Practice: Mass Problems

1. Jacqueline is sending three presents in one box by truck to the U.S. If the masses of the presents are 25 kg, 32 kg and 550 kg respectively and the mass of the box is 2 kg, what is the total mass of the box full of presents?

2. A courier company charges a $30.00 handling fee for packages over 100 kg. If the contents of Erin's package have masses of 25 500 g, 36 000 g, 19 500 g and 20 500 g, will she be charged the $30.00 handling fee?

3. At the gym, Ali places two 50 kg plates, four 25 kg plates and two 10 kg plates on the bar to match his personal best lift. What mass represents Ali's personal best?