LEARNER GUIDE

LLN READY

Includes review questions

Training support material for:

RIICCM201E

Carry out measurements and calculations

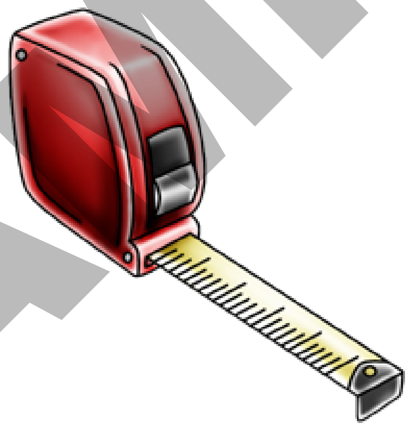
TRAINER'S GUIDE

Produced by:

EASY GUIDES
Australia Pty Ltd

CONTENTS

INTRODUCTION TO MEASUREMENTS AND CALCULATIONS



Measurements and calculations

Measurements and calculations are used in the resources and infrastructure industries for many different tasks. Measurements and calculations must be accurate and clearly recorded. It includes using measurements and calculations to estimate quantities for various work activities.

Accurate measurements and calculations will make sure that:

Correct quantities of materials are ordered

Materials are cut to correct sizes

The work is done in line with plans and specifications

Waste is kept to a minimum.

Think of the environment.

Quotes are accurate

Work is carried out safely

Units of measure (continued)

The weight or mass of an object can be measured in:

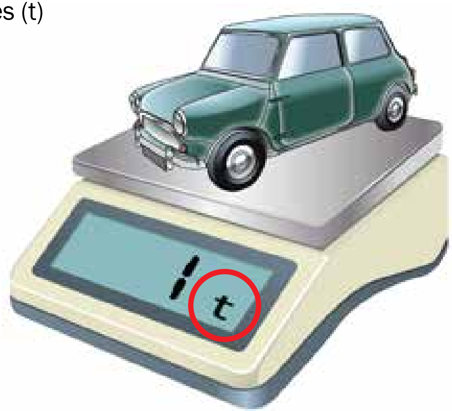
Milligrams (mg)

Something that weighs one milligram is almost impossible to see with the naked eye.

Grams (g)

Kilograms (kg)

Metric tonnes (t)

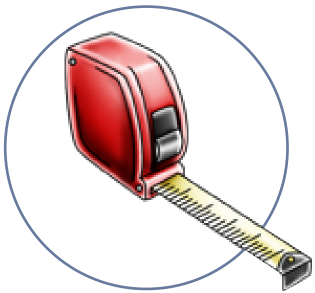


Units of measure (continued)

These tables show how metric and imperial weights and measurements compare with each other.

Metric →	Imperial
1 millimetre	0.03937 inches
1 centimetre	0.3937 inches
1 metre	1.0936 yards
1 kilometre	0.6214 miles
2.54 cm	1 inch
30.48 cm	1 foot
91.44 cm	1 yard
1.6093 km	1 mile

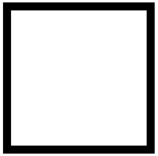
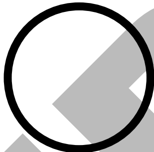
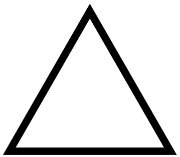
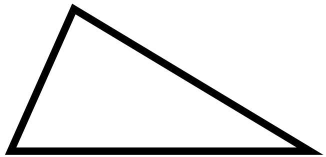
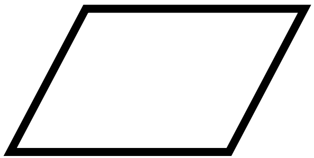
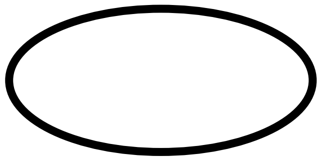
Imperial →	Metric
0.0353 ounces	1 gram
2.2046 pounds	1 kilogram
1.1023 short tonne	1 metric tonne
1 ounce	28.350 grams
1 pound	453.59 grams
1 short tonne	0.9072 metric tonnes



Basic shapes

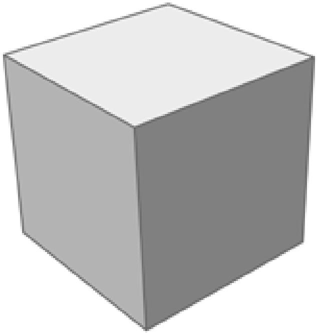
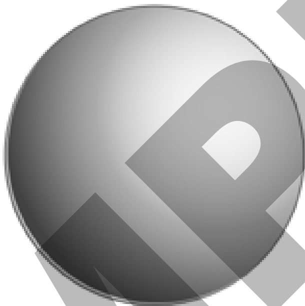
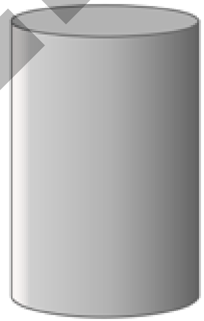
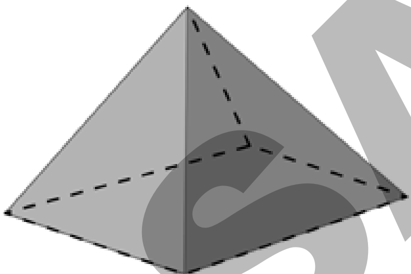
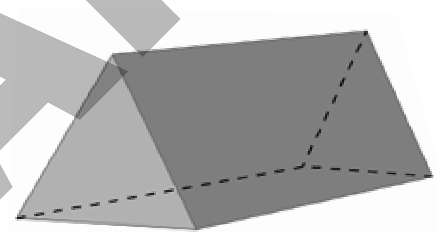
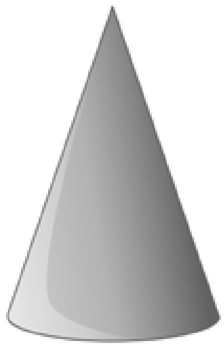
Shapes can be described as either **two dimensional (2D)** or **three dimensional (3D)**.

Two dimensional (2D)

Square 	Circle 	Rectangle 
Equilateral triangle  3 equal sides and 3 equal angles – always 60°	Isosceles triangle  2 equal sides and 2 equal angles	Scalene triangle  No equal sides and no equal angles
Trapezoid 	Parallelogram 	Ellipse 

Basic shapes (continued)

Three dimensional (3D)

Cube 	Sphere 	Cylinder 
Square pyramid 	Triangular prism 	Cone 

Basic mathematics symbols

Addition (plus) $+$ For example, 6 **+** 2 = 8	Subtraction (minus) $-$ For example, 6 **−** 2 = 4	Multiply (times) $\times$ or $*$ For example, 6 **×** 2 = 12	Divide (how many) $\div$ or $/$ For example, 6 **÷** 2 = 3
Equals (total) $=$ For example, 6 **=** 3 + 3	Brackets $(\ )$ For example, 6 + **(** 3 × 2 **)**	Greater than $>$ For example, 5 **>** 4	Less than $<$ For example, 4 **<** 5
Powers $2^2\ 2^3$ For example, $2^{\mathbf{2}} = 2 \times 2 = 4$ $2^{\mathbf{3}} = 2 \times 2 \times 2 = 8$	Square root $\sqrt{\ }$ For example, $\sqrt{25} = 5$	Fraction $^1/_4$ For example, 1 out of 4	Decimal 0·5 For example, ½ is the same as 0·5
Percentage % For example, 50% = 50 out of 100	Not equal to $\neq$ For example, $5 \times 2 \neq 30$	Degrees $^\circ$ 15 For example, 90° angle	Pi π For example, = 3.14159

BODMAS

A long time ago it was agreed that certain rules need to be followed when doing calculations. An order of operations was created and given the acronym **BODMAS**. Bodmas is a simple way of remembering which part of a calculation to do first, then the order in which the rest must be done.

1. **B**rackets first.

$$5 + (6 + 4)$$

Becomes $5 + 10 = 15$

The section in brackets is always done first.

2. **O**rders (for example, powers and square roots).

$$10 - 3^2$$

Becomes $10 - 9 = 1$

The power is done first then subtracted from 10.

3. **D**ivision and **M**ultiplication – If the calculation contains both division and multiplication they are done in the order of left to right.

$$10 \div 2 \times 5$$

Becomes $5 \times 5 = 25$

4. **A**ddition and **S**ubtraction – If the calculation contains both addition and a subtraction they are done in the order of left to right.

$$2 + 6 - 5$$

Becomes $8 - 5 = 3$

BODMAS (continued)

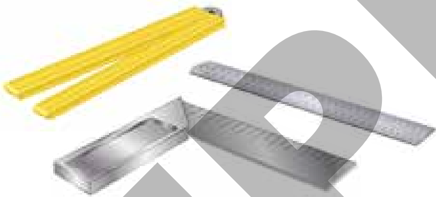
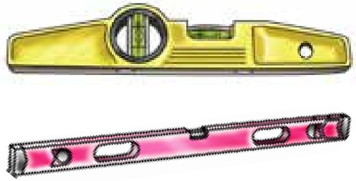
The table below shows how **BODMAS** works with a sum containing all of the operations.

$2 + 6^2 - (3 \times 3) \div 3 \times 2 =$	
First do the **B**rackets	$2 + 6^2 - \mathbf{(3 \times 3)} \div 3 \times 2$
Becomes	$2 + 6^2 - \mathbf{9} \div 3 \times 2$
Next do the **O**rders	$2 + \mathbf{6^2} - 9 \div 3 \times 2$
Becomes	$2 + \mathbf{36} - 9 \div 3 \times 2$
Next do the **D**ivision	$2 + 36 - \mathbf{9 \div 3} \times 2$
Becomes	$2 + 36 - \mathbf{3} \times 2$
Next do the **M**ultiplication	$2 + 36 - \mathbf{3 \times 2}$
Becomes	$\mathbf{2 + 36} - \mathbf{6}$
Next do the **A**ddition	$2 + 36 - 6$
Becomes	$\mathbf{38} - 6$
Next do the **S**ubtraction	$\mathbf{38 - 6}$
And the answer	$= \mathbf{32}$

Tools and equipment

Various tools and equipment can be used to carry out measurements and calculations.

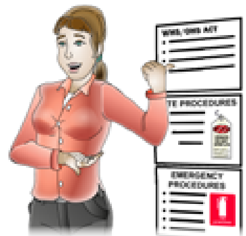
Some examples are:

Tape measure 	Rulers and squares 	Weighing scale 
Calculator 	Measuring wheel (trundle wheel) 	Levels 
Digital laser measuring tool 	Computer 	Smart phone and tablet 

PLAN AND PREPARE FOR MEASUREMENTS AND CALCULATIONS

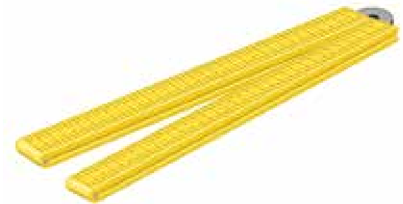
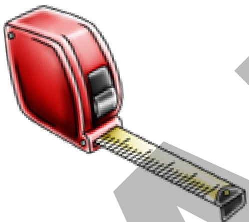
Element 1

Compliance documents (continued)

Document type	Where to find
Manufacturers manuals and specifications 	Attached to equipment and machinery 
Worksite rules and procedures 	Site rules and procedures should be explained during site induction or located in the site office 
Equal employment opportunity and discrimination legislation 	www.fairwork.gov.au Australian Government Fair Work OMBUDSMAN
Note: If you are unsure where to find information, speak to your OHS/WHS representative or supervisor.	

Select and check tools and equipment

Before measuring or calculating it is important to make sure you select the correct tools to do the job. All tools and equipment need to be checked for faults to make sure the job can be done safely, accurately and efficiently.

Tool/equipment	Use	Check
Ruler 	Measuring	☑ Numbering is clear and readable
Tape measure 	Measuring	☑ Numbering is clear and readable ☑ Blade retracts and locks in position
Digital laser measuring tool 	Measuring	☑ Calibration ☑ Batteries are working ☑ Display screen is undamamged ☑ All buttons are operational

Select and check tools and equipment (continued)

Tool/equipment	Use	Check
Measuring wheel (trundle wheel) 	Measuring	☑ Counter is operational ☑ All buttons are operational ☑ Display screen is undamaged ☑ Wheel is undamaged
Scales 	Weighing	☑ Calibration ☑ Display screen is undamaged ☑ Power cords undamaged ☑ All buttons are operational
Calculator 	Calculations	☑ All buttons are operational ☑ Batteries ☑ Display screen is undamaged

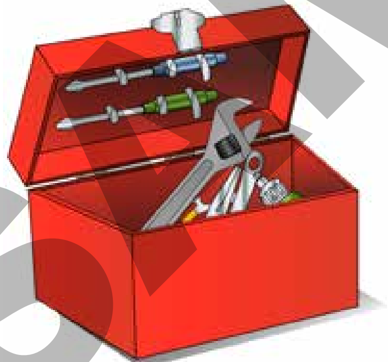
Select and check tools and equipment (continued)

Measuring tools can be high precision and sensitive pieces of equipment. You must care for and maintain this equipment to make sure it remains accurate. Electronic measuring equipment in particular can be highly sensitive.

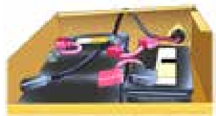
Do not throw or drop measuring equipment as the sudden shock can cause damage.

Keep measuring equipment clean and dry.

Keep measuring equipment in protective cases and do not store with hand tools like hammers and chisels.



Remove batteries if the equipment is not going to be used for a long period of time.

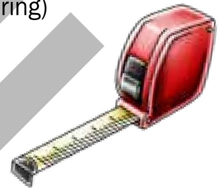


QUESTION 5

List four (4) pieces of equipment that can be used for measuring or calculating.

Ruler

Measuring tape (measuring)



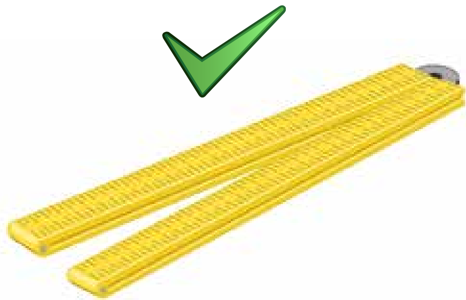
Calculator

Computer

QUESTION 6

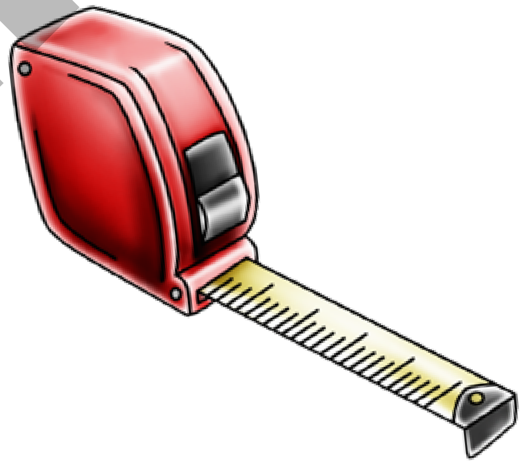
Why is it important to make sure tools and equipment are in good condition before starting work?

To make sure work is carried out safely, accurately and efficiently.



PERFORM MEASUREMENTS

Element 2



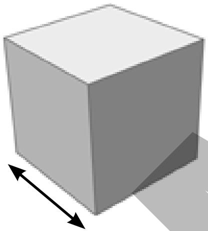
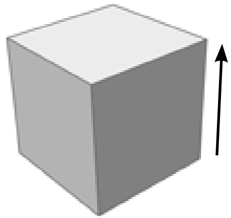
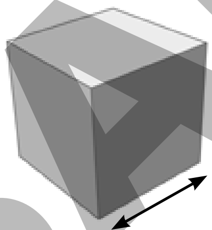
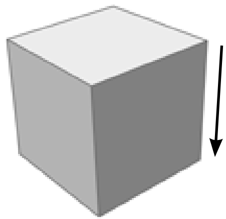
Measurement methods

When you need to measure something it is important to choose the correct way of doing it so results are accurate.

There are many different ways to measure things and different formulas that can be applied depending on the information you need and the object you have to measure.

Length, height, width and depth

Length, height, width and depth measurements are performed by measuring in a straight line from one point to another, this will give you the distance between the two points.

Length 	Height 
Width 	Depth 

View examples on the next page

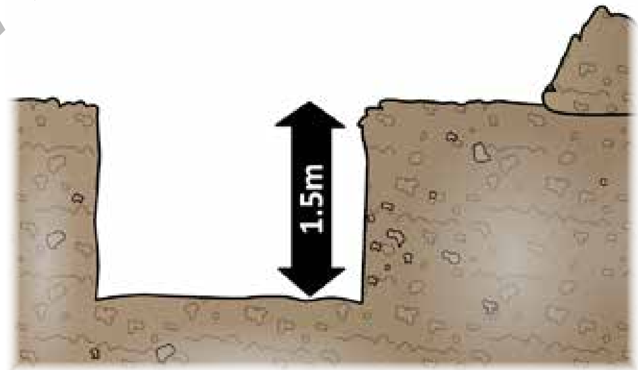
Length, height, width and depth (continued)

How long is the road?

How high is the bridge?

How wide is the road?

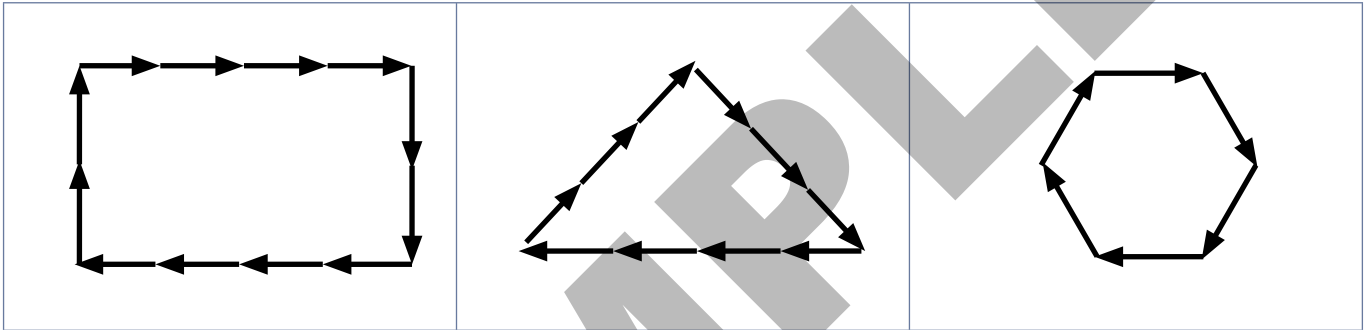
How deep is the excavation?



Measurement methods – examples (continued)

Perimeter

Perimeter is the measurement of distance around the outside of a two dimensional shape.



For example:

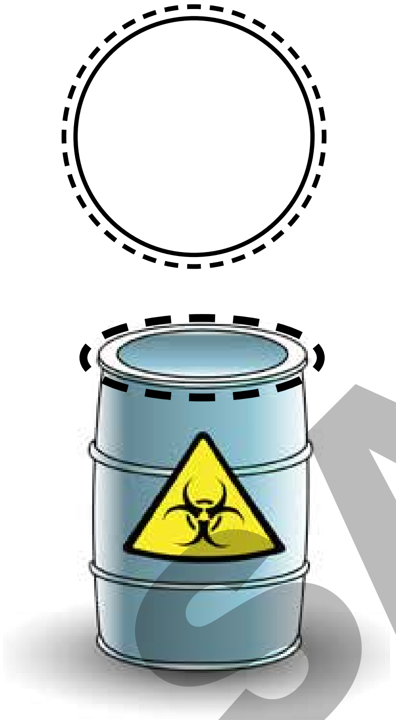
If you wanted to work out how much fencing was required to go around a job site, you would measure the distance on the outside of the site (around the perimeter).

Measurement methods (continued)

Circumference, diameter and radius

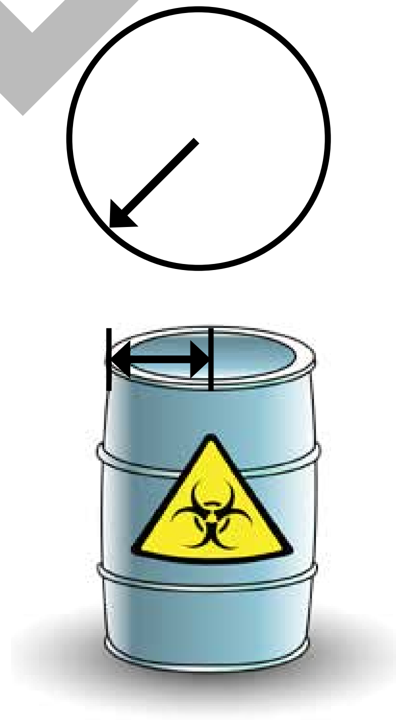
Circumference, diameter and radius are measurements that can be taken on a closed circular or curved object.

Circumference
– around the outside



Diameter
– from one side to the other side

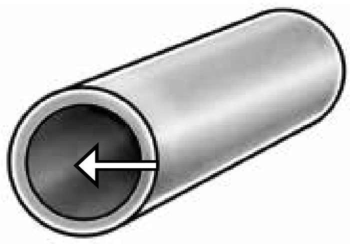
Radius
– from the edge to the centre



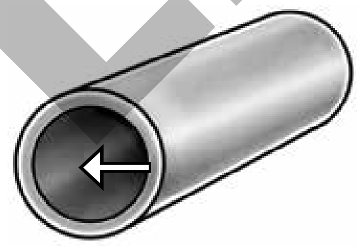
Circumference, diameter and radius (continued)

If you are measuring the diameter or radius of a pipe you need to know if it is the inside or outside radius or diameter that needs to be measured.

Outside radius



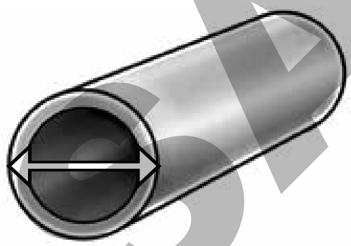
Inside radius



If you need to know how much space a pipe would take up you need the outside radius/diameter to calculate the volume.

If you need to know how much water a pipe could hold you would need to know the inside radius/diameter to calculate the volume.

Outside diameter (O/D)

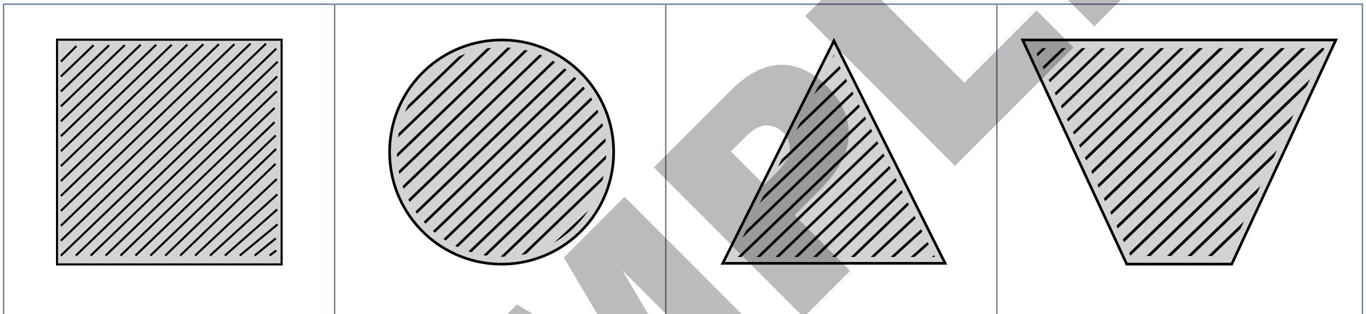


Inside diameter (I/D)

Measurement methods (continued)

Area

Area is the size of a surface. Area can also be called surface area. The standard unit of measure for area is metres squared (m^2). A square metre is the same as a square on which all sides equal 1 metre.



For example:

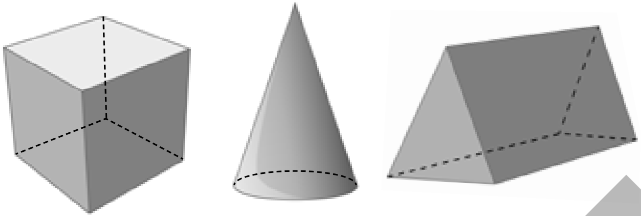
You would calculate the area of a wall to work out how much paint is needed to cover the wall.

This is because you only need to know how much area the paint needs to cover, the thickness of the paint is not important.

Measurement methods (continued)

Volume

Volume is the amount of space inside a three-dimensional shape. The standard unit of measure for volume is cubic metres (m^3)



For example: If you had to fill in a trench, you could measure the volume so you know how much soil is required.

Weight

Weight is the amount or quantity of heaviness of an object or material. Weight can be measured using scales or by performing calculations. Technically the measure for weight is Newtons (n).

9.8 newtons are the same as one kilogram. However, we almost always refer to weight in either milligrams, grams, kilograms or tonnes.

- The brain of a honey bee weighs approximately 1 milligram
- A paperclip weighs approximately 1 gram
- One litre of milk weighs approximately 1 kilogram
- A small car weighs approximately 1 tonne.

For example: You might have to measure and calculate the weight of soil you are loading into a tip truck so you do not overload it.