Measurements

Saturday, August 29, 2020 11:46 AM

1.1:
7 Base Units

SI Base Units			
Quantity	Symbol	Unit	Abbreviation
Length	l	meter	m
Mass	m	kilogram	kg
Time	t	second	s
Temperature	T	kelvin	K
Electric Current	i	ampere	A
Amount	n	mole	mole
Luminous Intensity	I_v	cd	Candela

https://www.google.com/url?sa=i&url=http%3A%2F%2Fwww.basicsofelectricalengineering.com%2F2017%2F07%2Fsi-base-and-derived-units-for.html&psig=AOvVaw2ubheYInoNwB21b8Z2spsh&ust=1598772333908000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCIjP56Dxv-sCFQAAAAAdAAAAABAI

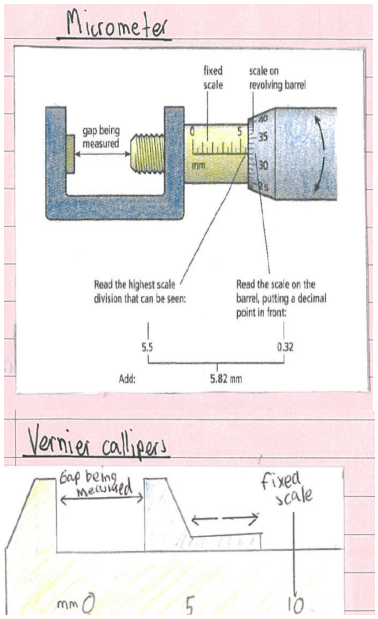
Measurement of Length and Volume

Rulers are used to measure the length of an object. The more divisions the ruler has, the more accurate it will be. In order to measure length at much smaller values,, 2 instruments are used:

1) Vernier Calipers
2) Micrometer Screw Gauge

Vernier Calipers - nearest 0.1mm
Micrometer Screw Gauge - nearest 0.01mm

(igcsesciencenotes.wordpress.com)

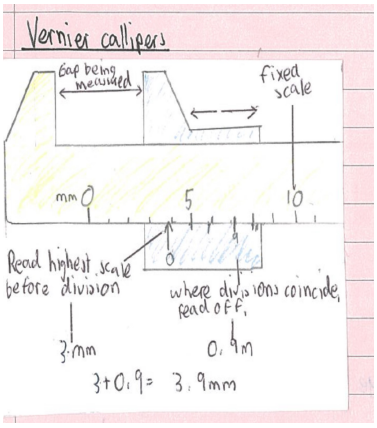


Vernier Calipers are read by first reading where the scale intersects right before the division. This is the bigger reading. Afterwards, pay attention where the divisions come together. This is your smaller reading. Final reading is obtained by adding them up.

Micrometer screw gauge, on the other hand, is read by first reading, where the highest scale division is still visible. For eg, if 5.1 is seen but not 5.2 although the measurement is more than 5.1, 5.1 is still taken. Afterwards, read the barrel and where it alights along the scale. This is the smaller reading. Afterwards, add the value.

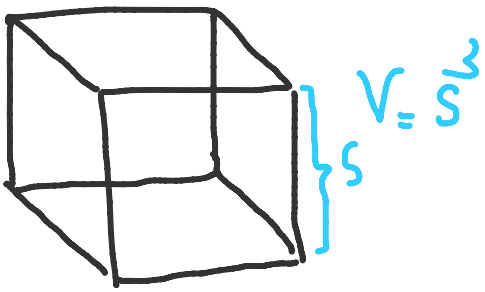
With respect to both of these instruments, it is important to understand the concept of zero error. Zero error will always deviate your value from the length's true value to one side. It is not required to understand the calculation behind eliminating zero error but the understanding of this concept is crucial. It leads to what is known as systematic error which is error caused by the device.

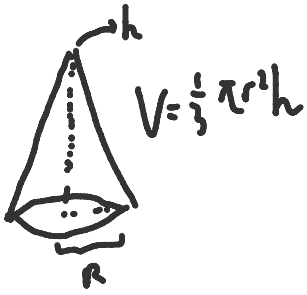
A question often asked is how are you able to measure the thickness of one sheet of paper. It is not reliable to take a direct reading. Rather, 50 sheets of paper are piled on top of one another and a Vernier Caliper takes its reading, The experiment is then repeated another 2 times are various parts of the paper and then averaged in order to increase reliability of results. To find individual thickness, it is then divided by 50.

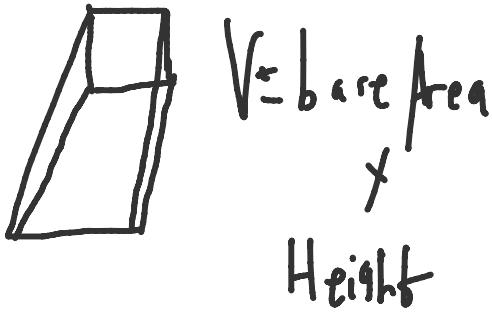


A question often asked is how are you able to measure the thickness of one sheet of paper. It is not reliable to take a direct reading. Rather, 50 sheets of paper are piled on top of one another and a Vernier Caliper takes its reading, The experiment is then repeated another 2 times are various parts of the paper and then averaged in order to increase reliability of results. To find individual thickness, it is then divided by 50.

In order to measure volume, dimensions of the object needs to be first measured. If the object is of regular shape as that of a cube, volume can then be measured by taking the length of one side and cubing it.

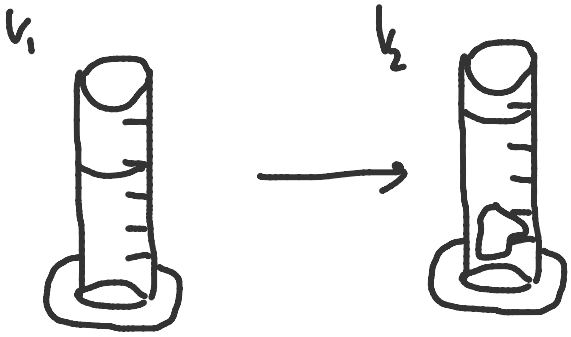






On the other hand, other shapes such as that of a cylinder and prism requires more thorough thought. Nevertheless, all these shapes' volumes can be measured with a rule. It is best to memorize the formulas to obtain the volume for these shapes as they commonly appear in the exams.

In the case of an irregular object, a method called Displacement Method is being implemented.



$$\rho = m \times V$$

$$m = \frac{\rho}{V_2 - V_1}$$

Time:

Can use stopwatch to measure interval of time. Digital stopwatches are much more accurate in a sense it can normally measure up to 0 0.01s. However, the main issue is human reaction time when handling these devices.

P:S: For maximum precision as well as accuracy, light gates can be used where time is automatically registered with minimal lag when a certain condition is achieved.

$T = 2\pi\sqrt{\frac{L}{g}}$ where L is length of string and g is acc due to gravity $\therefore 9.8 m/s^2$

To find period of 1 oscillation, similar technique is used with respect with the thickness of 1 sheet of paper. Time is taken for 50 oscillations and then proportionality is used to find 1 oscillation.
With respect to the equation above, it is crucial to understand that the **only factor affecting the period of a pendulum is only the length of the string.** Acceleration due to gravity is nearly equal across the world and hence, an experiment can be done where an **experimental value of g can be obtained.**