

Measurement



**Accuracy, Precision and Uncertainty in
Measurement**

Uncertainty

www.saburchill.com/physics/chap03.html



Describing measurements

Accuracy- How close the measurement is to the actual answer

"Did you get the right answer?"

Precision- How well the measurement can be repeated

"Did you get the same answer again?"

Three students measure the length of the classroom.

student 1 measures 22.4 m

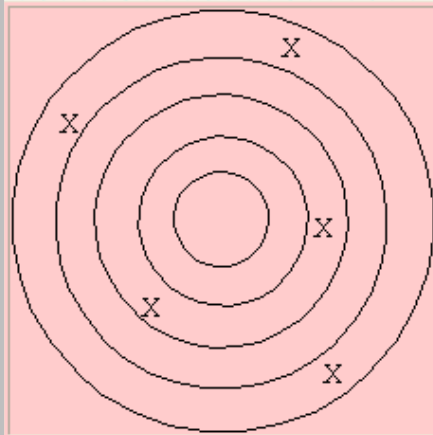
student 2 measures 22.3 m

student 3 measures 22.35m

Were the measurements accurate?

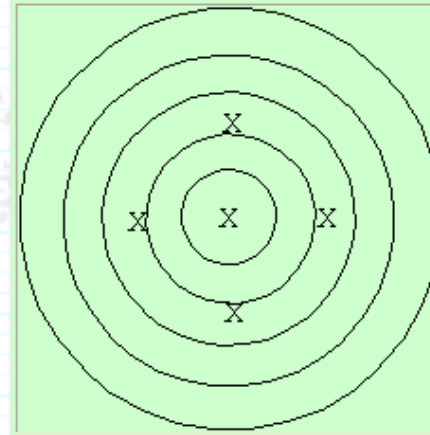
Which was the most precise?

Neither Precise Nor Accurate



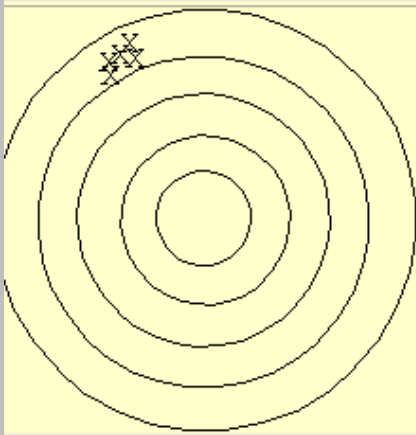
This is a randomlike pattern, neither precise nor accurate. The darts are not clustered together and are not near the bull's eye.

Accurate, Not Precise



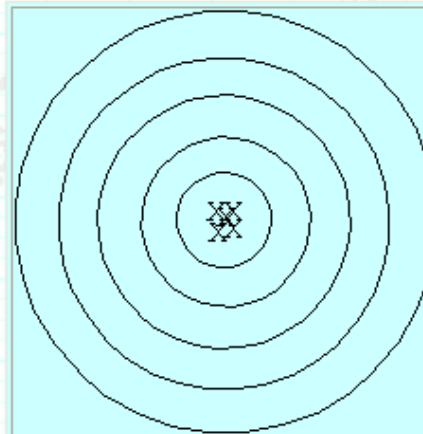
This is an accurate pattern, but not precise. The darts are not clustered, but their 'average' position is the center of the bull's eye.

Precise, Not Accurate



This is a precise pattern, but not accurate. The darts are clustered together but did not hit the intended mark.

Precise and Accurate

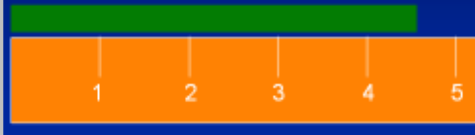


This pattern is both precise and accurate. The darts are tightly clustered and their average position is the center of the bull's eye.

Always estimate your measurement one place past the smallest unit of measure on the device.

Significant figures (sig figs)

- | How many numbers mean anything.
- | When we measure something, we can (and do) always estimate between the smallest marks.



Smallest Unit = cm
measure to .1 cm (mm)

answer should have 2 sig fig

answer _____ cm

Significant figures (sig figs)

- | The better marks the better we can estimate.
- | Scientist always understand that the last number measured is actually an estimate.

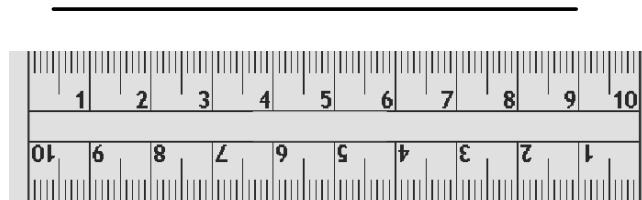


Smallest Unit = mm
measure to .1 mm

answer should have 3 sig fig

answer _____ cm

How long is the line?



Ask yourself these questions.

1. What is the smallest measure on the ruler?
2. the numbers on the ruler are what unit?
3. How many sig fig will I have after that unit?

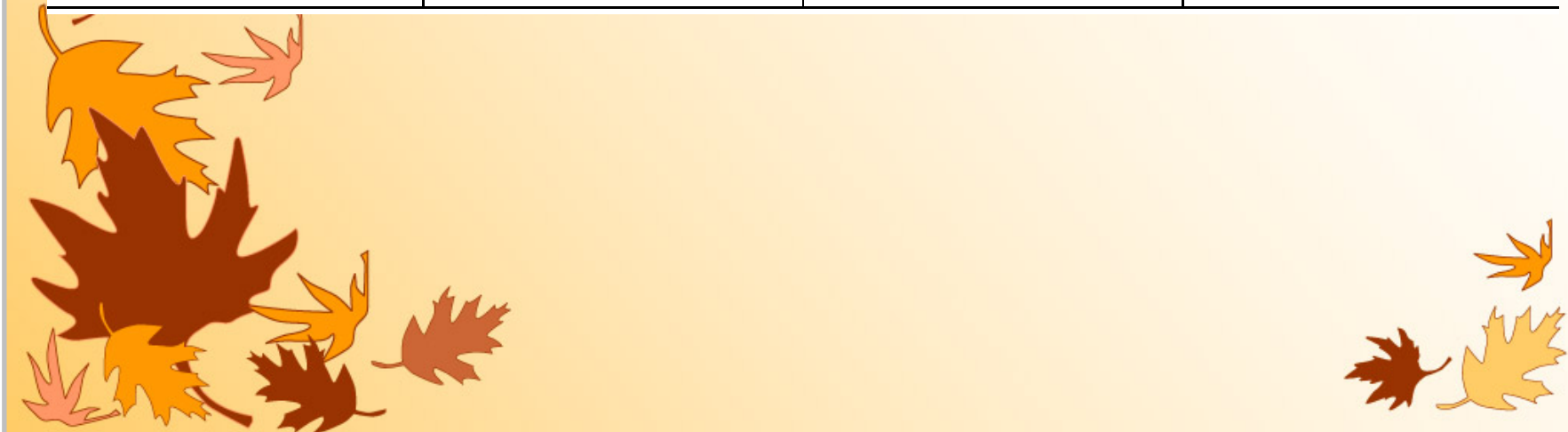
Base Quantity	Name of unit	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electrical Current	Ampere	A
Temperature	Kelvin	K
Amount of Substance	Mole	mol
Luminous Intensity	Candela	cd

Table 2.1b Derived Units

Base Quantity	Common Units
Volume	dm ³
Density	g/ml kg/dm ³ g/cm ³
Acceleration	m/s ²
Force	kg x m/s ²

Metric Prefixes

Prefix	Abbreviation	Decimal Number	Exponential Factor
Giga-	G	1000000000	10^9
Mega-	M	1000000	10^6
Kilo-	k	1000	10^3
Hecto-	h	100	10^2
Deka	da	10	10^1
Deci-	d	.1	10^{-1}
Centi-	c	.01	10^{-2}
Milli-	m	.001	10^{-3}
Micro-	μ	.000001	10^{-6}
Nano-	n	.000000001	10^{-9}
Pico-	p	.000000000001	10^{-12}
Femto-	f	.000000000000001	10^{-15}



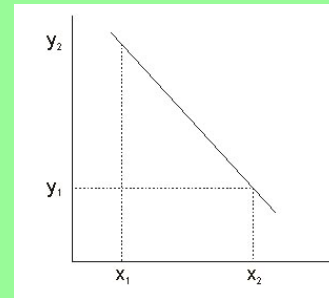
Graphs

Best fit lines

<http://www.saburchill.com/physics/chapters/0073.html>

Slope

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}}$$



Slope of a Line

$f(x) = 1.5x$

m **1.5**

c **0**

ZOOM IN

SMART Technologies

Quiz

(go to quiz zone)

<http://www.physicslessons.com/>

