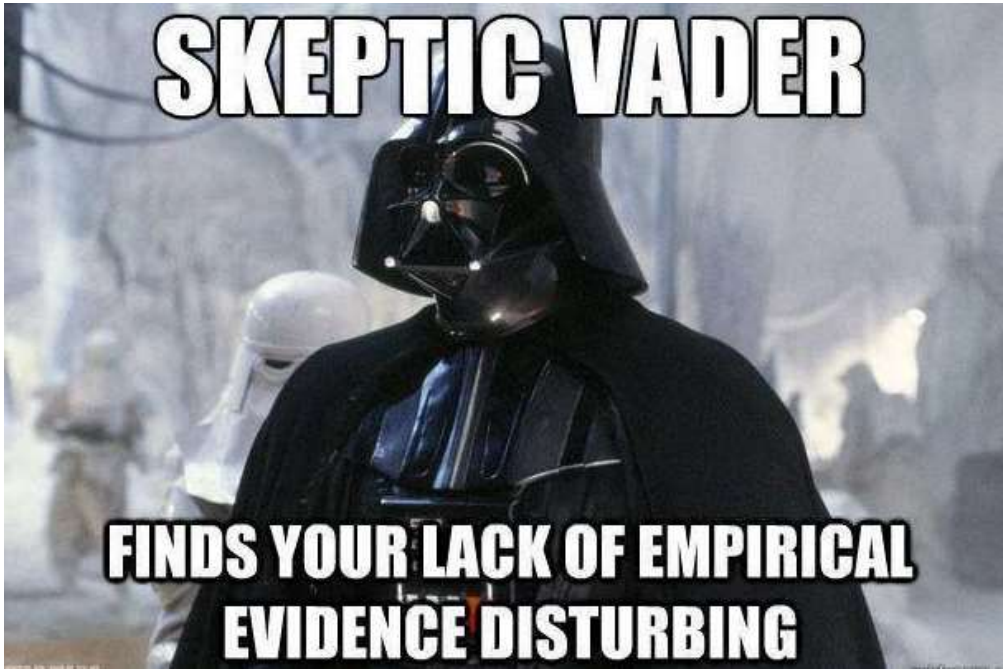
Monday, August 19, 2019

Welcome to Investigative Science with Mr. Fireng



1. Get out your stampsheet
2. Get out your homework
3. Write tomorrow's homework in agenda
4. START WORKING QUIETLY

Investigative Science

Learning goal: Properly apply all steps in the scientific method when problem solving.

Learning goal: Properly apply all steps in the scientific method when problem solving.

Learning scale:

1	2	3	4
Name the steps	Name the steps and follow directions in an investigation	Can design and conduct an investigation leading to a conclusion	Design and carry out an investigation leading to a valid and rational conclusion

Student's self-evaluation: *Complete at home or at the end of class, use the 4-3-2-1 Learning scale (two to three sentences).*

4
Design, complete, valid conclusion

3
Design & complete

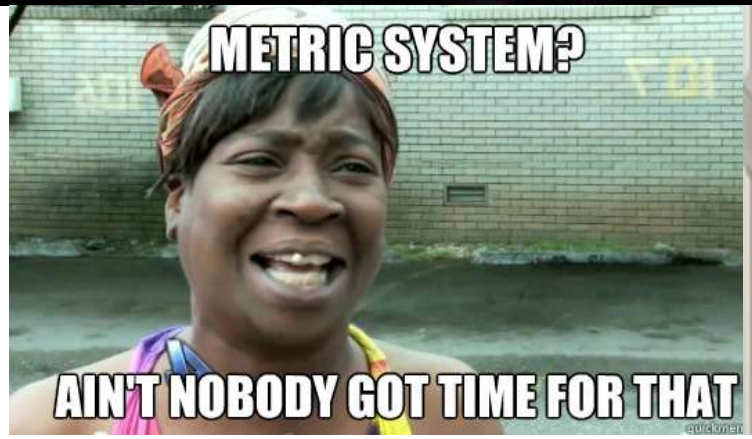
2
Know steps, follow directions

1
Know the steps

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review



4
Evaluate based on A&P

3
Distinguish A&P in data

2
Importance of A&P

1
Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

Countries That Don't Use the Metric System

- Liberia
- Myanmar (a.k.a. "the country formerly known as Burma")
- United States of America

4
Evaluate based on A&P

3
Distinguish A&P in data

2
Importance of A&P

1
Define A&P

Investigative Science

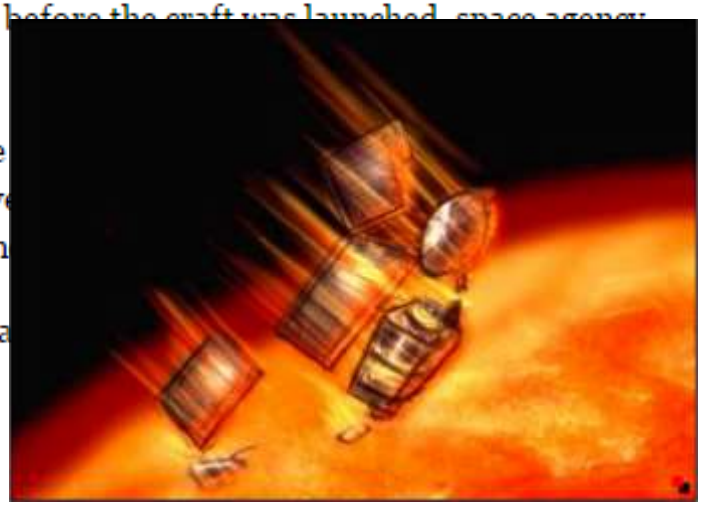
Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

Mars Probe Lost Due to Simple Math Error

October 01, 1999 | ROBERT LEE HOTZ | TIMES SCIENCE WRITER

NASA lost its $125-million Mars Climate Orbiter because spacecraft engineers failed to convert from English to metric measurements when exchanging vital data before the craft was launched, space agency officials said Thursday.



A navigation team at the Jet Propulsion Laboratory used the its calculations, while Lockheed Martin Astronautics in Denv provided crucial acceleration data in the English system of in

As a result, JPL engineers mistook acceleration readings mea a metric measure of force called newton seconds.

In a sense, the spacecraft was lost in translation.

"That is so dumb," said John Logsdon, director of George Washington University's space policy institute. "There seems to have emerged over the past couple of years a systematic problem in the space community of insufficient attention to detail."

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

The Metric System

The metric system is a measurement system based on our decimal (base 10) number system.

Uses "SI" units or "International System of Units"; The widely excepted system of measurement.

4
Evaluate based on A&P

3
Distinguish A&P in data

2
Importance of A&P

1
Define A&P

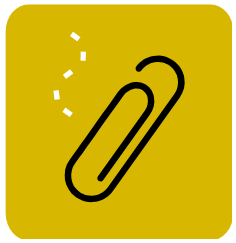
Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

SI unit for length is the Meter (m)

One **centimeter** is about the width of a **large** paper clip



A **meter** is about the width of a doorway

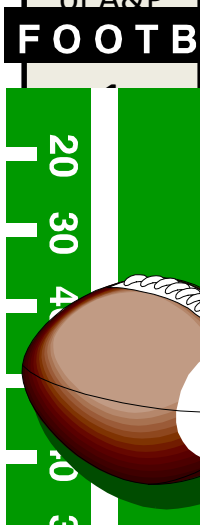
One **millimeter** is about the thickness of a dime.

A **kilometer** is about six city blocks or 10 football fields.

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P



Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

SI unit for mass is the Gram (g)

1 **gram** weighs about as much as a small paper clip.

1 **kilogram** weighs about as much as 6 apples or 2 pounds.

A **milligram** weighs about as much as a grain of salt.

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

gative Science

ke accurate and precise measurements
icant figures when collecting and

Review

2 Liter Soda

Liters: measure volume

1 **liter** is half a big bottle of soda

A **kiloliter** would be about 500 2-liter bottles of pop

1 **milliliter** is about the amount of one drop

4 Evaluate based on A&P
3 Distinguish A&P in data
2 Importance of A&P
1 Define A&P

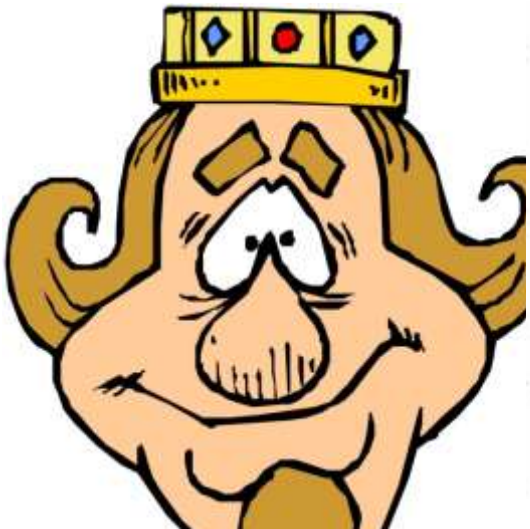
Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

Pneumonic device to memorize prefixes

King Henry Died Unexpectedly Drinking Chocolate Milk



SI Prefix	Meaning
kilo-	thousand (1000)
hecto-	hundred (100)
deka-	ten (10)
deci-	tenth (0.10)
centi-	hundredth (0.01)
milli-	thousandth (0.001)

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

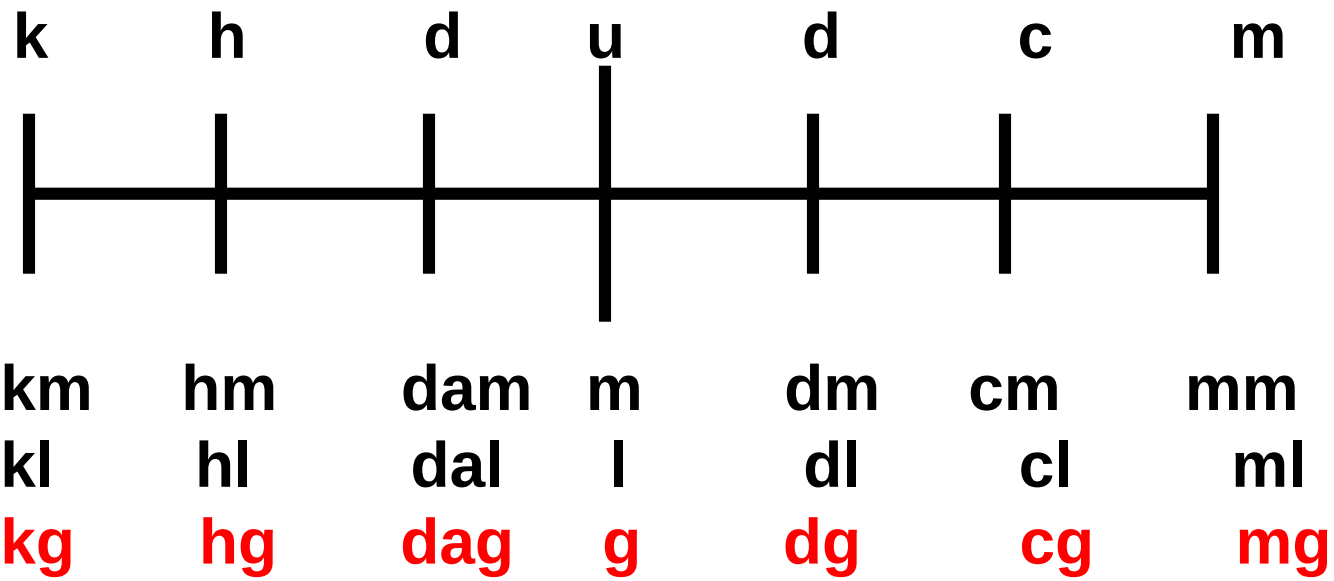
1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

Do: Let's add the gram line:



4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

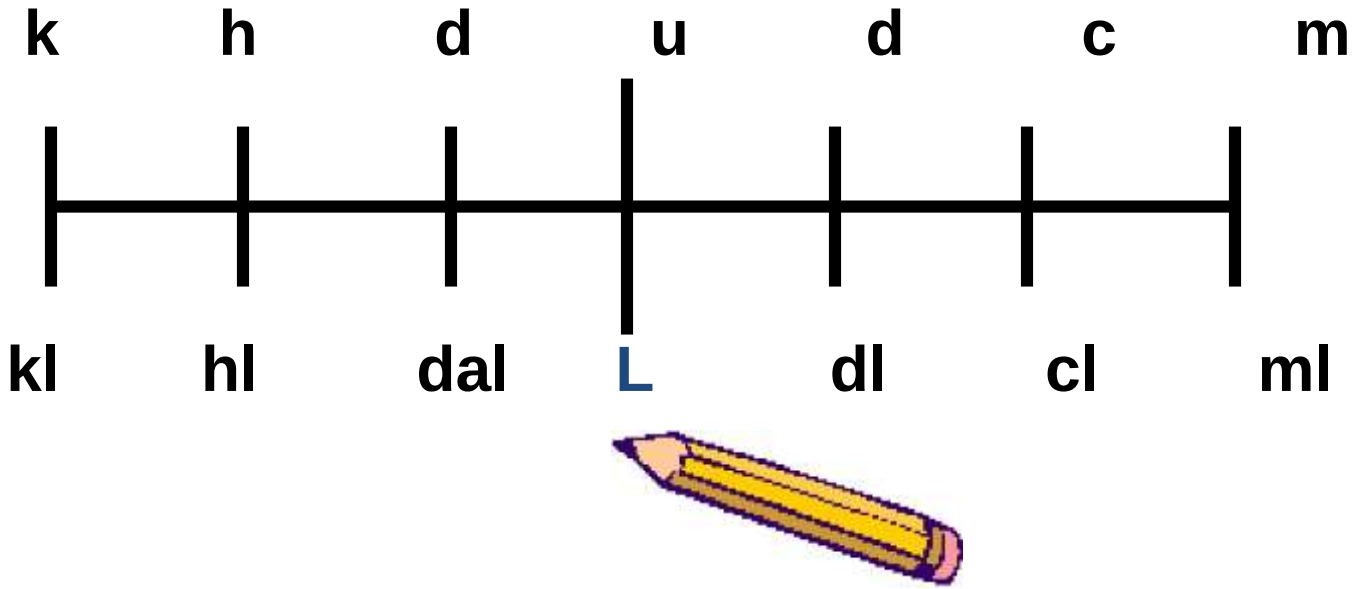
Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Example:

7.25 L = _____ kL

1. Look at the unit of the number you are converting from. On the device put your pencil on <u>that</u> unit.



4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

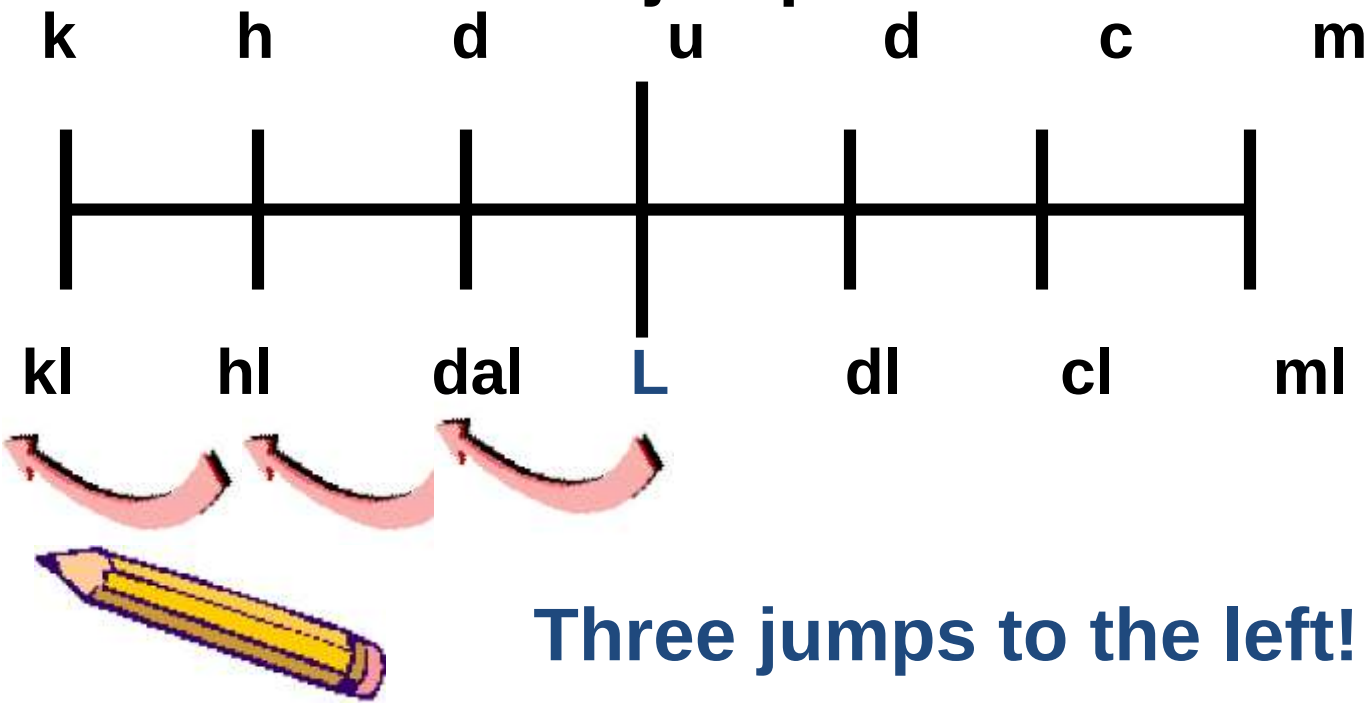
1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Example:

2. Move to the unit you are converting to, counting jumps and noticing the direction of the jump!



Three jumps to the left!

4 Evaluate based on A&P
3 Distinguish A&P in data
2 Importance of A&P
1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Review

Example:

3. Move the decimal that many places and in that direction. Add zeros if needed.

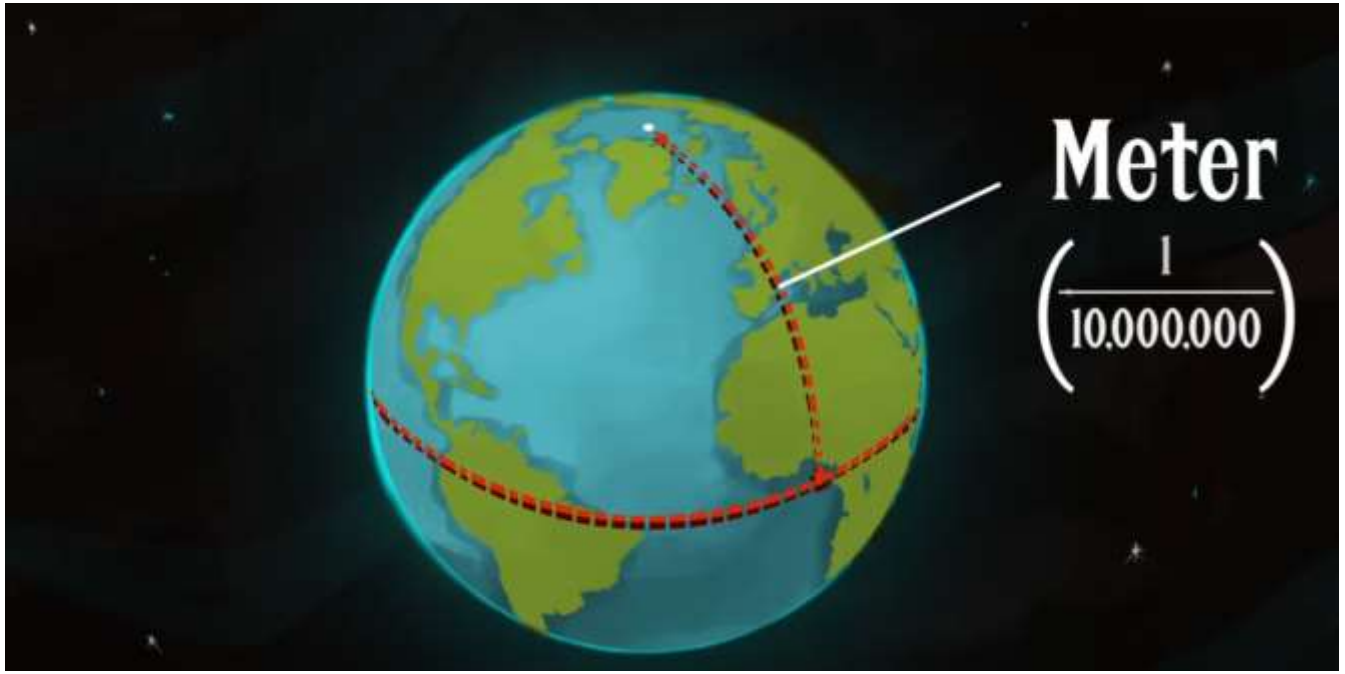
7.25 L = _____ kL

7.25 L = .00725 kL

4 Evaluate based on A&P
3 Distinguish A&P in data
2 Importance of A&P
1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.



4
Evaluate based on A&P

3
Distinguish A&P in data

2
Importance of A&P

1
Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Exact numbers

- When we count something, it is an ***exact number***.
- Significant digit rules do not apply to exact numbers.
- An example of an exact number: there are 3 coins on this slide.

A 1¢ coin

A 10¢ coin

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

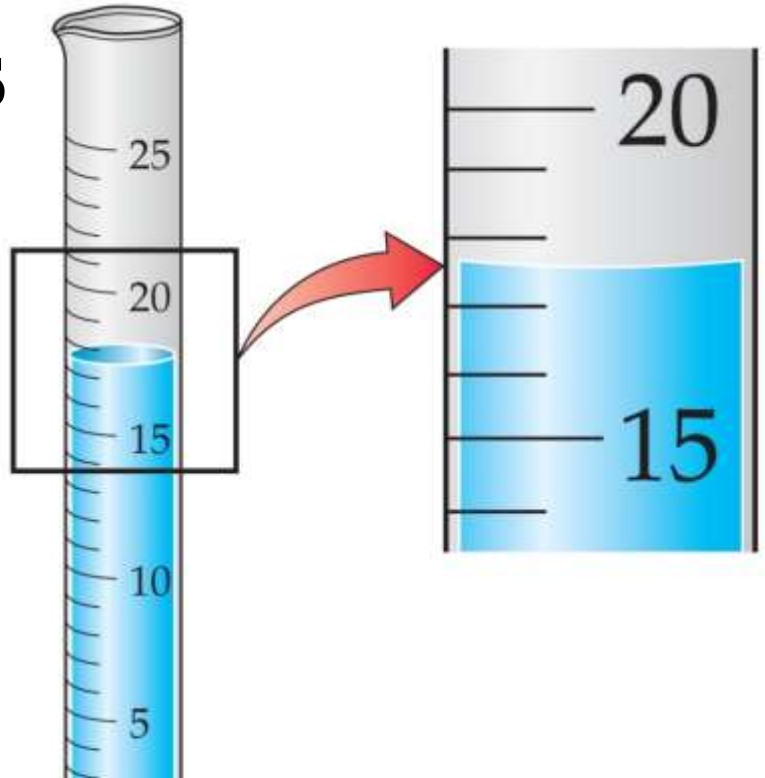
Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

When we measure, how precise can we report the measurement?

Measured numbers

Numbers that are derived from measurements

Every experimental measurement has a degree of uncertainty.



4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

A measurement is a quantity that has both a number and a unit.

2.34 g 36.1 mL 16.5 Years Old

Measurements are fundamental to the experimental sciences. For that reason, it is important to be able to MAKE measurements and to *decide* whether a measurement is CORRECT.

Are you "certain" that your measurement is correct? HOW "certain" are you???

4 Design, complete, valid conclusion

3 Design & complete

2 Know steps, follow directions

1 Know the steps

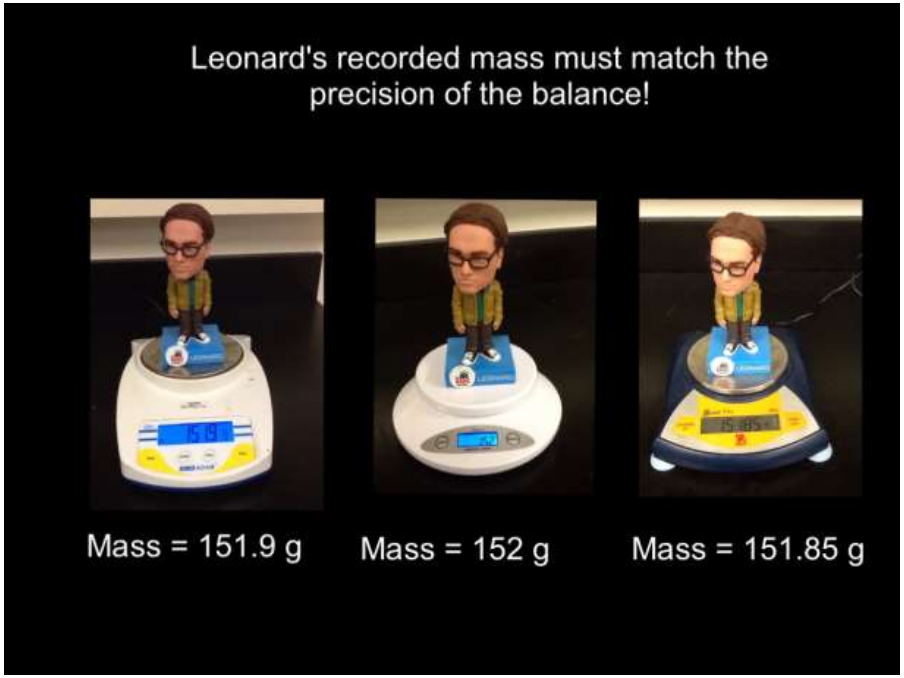
Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Page 06

Tues Wed July 28_29th

How do we make precise measurements? Use More sensitive instruments.



4
Design, complete, valid conclusion

3
Design & complete

2
Know steps, follow directions

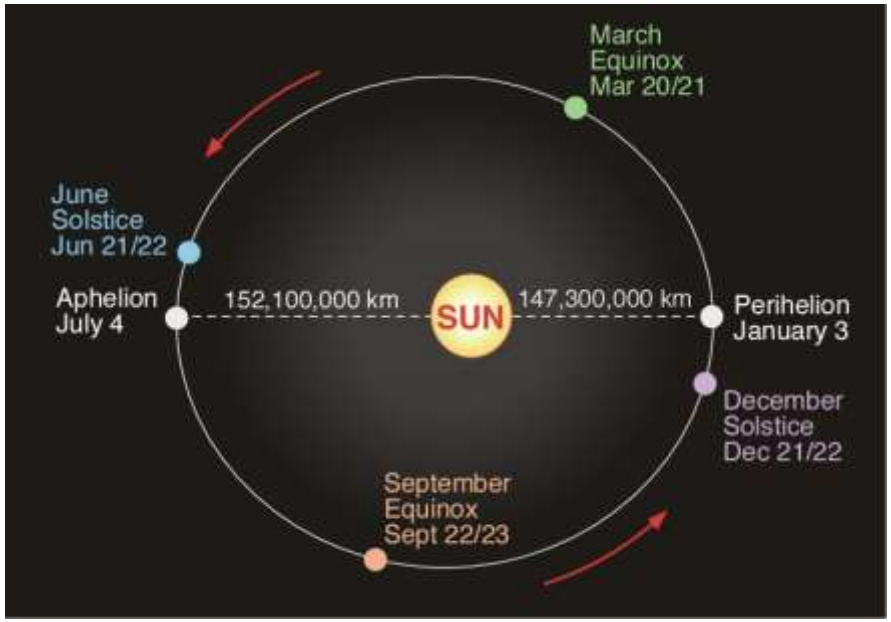
1
Know the steps

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

How precise do you need to be?

If we are measuring the distance from the Earth to the sun, does it really matter if you are off a couple of centimeters? NO!! Difference is not "significant"



4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

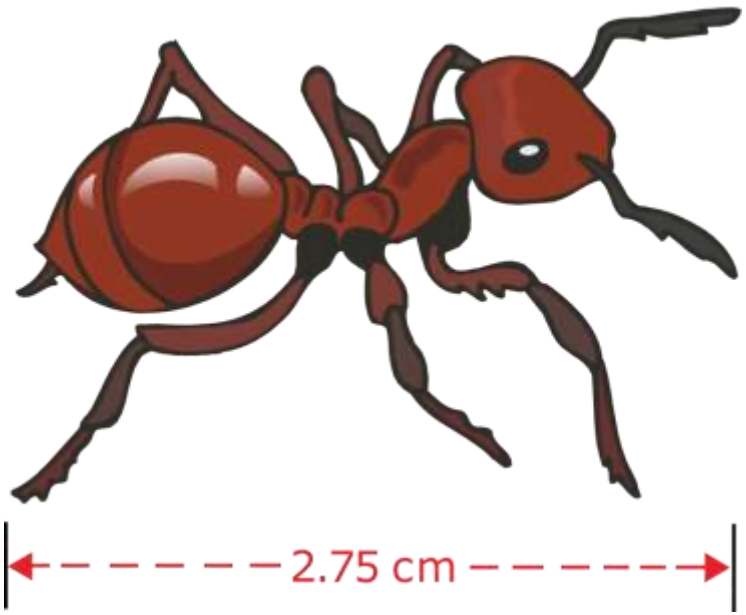
Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

How precise do you need to be?

But what if you were measuring the length of an ant??

Then! One centimeter is very significant!



4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Scienc

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

How do we make measurements precise? Use More sensitive instruments.

Consider the example below: Michael Phelps wins 200m Butterfly gold in Rio

Athlete	Event	Time	Medal
Michael Phelps (USA)	200m butterfly	1:53	Gold
Masato Sakai (Japan)	200m butterfly	1:53	Silver
Tamas Kenderesi (Hungary)	200m butterfly	1:53	Bronze

All the times above are accurate, but the low level of precision creates a three way tie. The time below are accurate and have a high level of precision.

Athlete	Event	Time	Medal
Michael Phelps (USA)	200m butterfly	1:53.36	Gold
Masato Sakai (Japan)	200m butterfly	1:53.40	Silver
Tamas Kenderesi (Hungary)	200m butterfly	1:53.62	Bronze

Design, complete, valid conclusion

3
Design & complete

2
Know steps, follow directions

1
Know the steps

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Uncertainty in measurements: When measuring, always estimate ONE place past the smallest mark

a Measured length = 0.6 m

Smallest unit= ones place..

Estimate to tenths place= 1.0

b Measured length = 0.61 m

Smallest unit= tenths place 0.60 M

Estimate to hundreds place 1.00

c Measured length = 0.607 m

Smallest unit= hundreds place 0.600 M

Estimate to thousands place 1.000

4 Evaluate based on A&P

3 Distinguish A&P in data

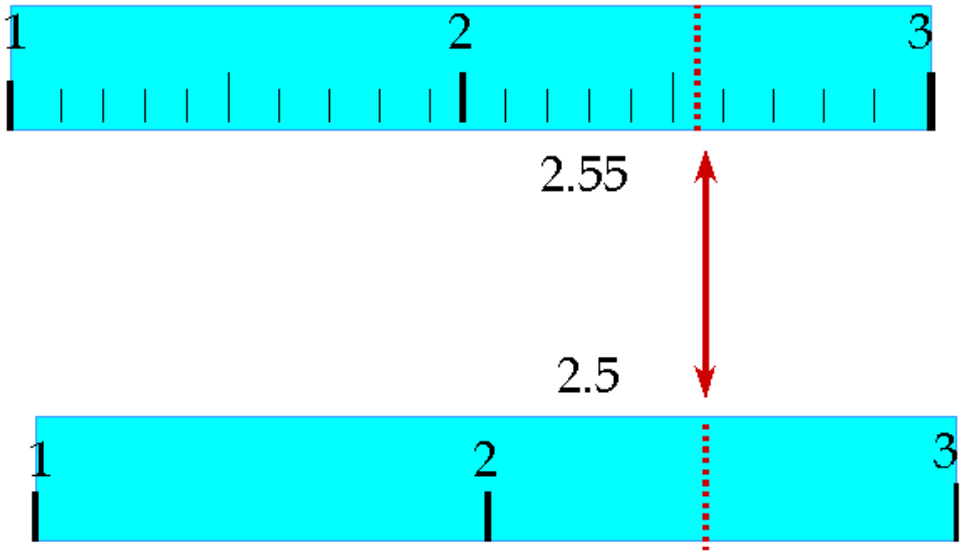
2 Importance of A&P

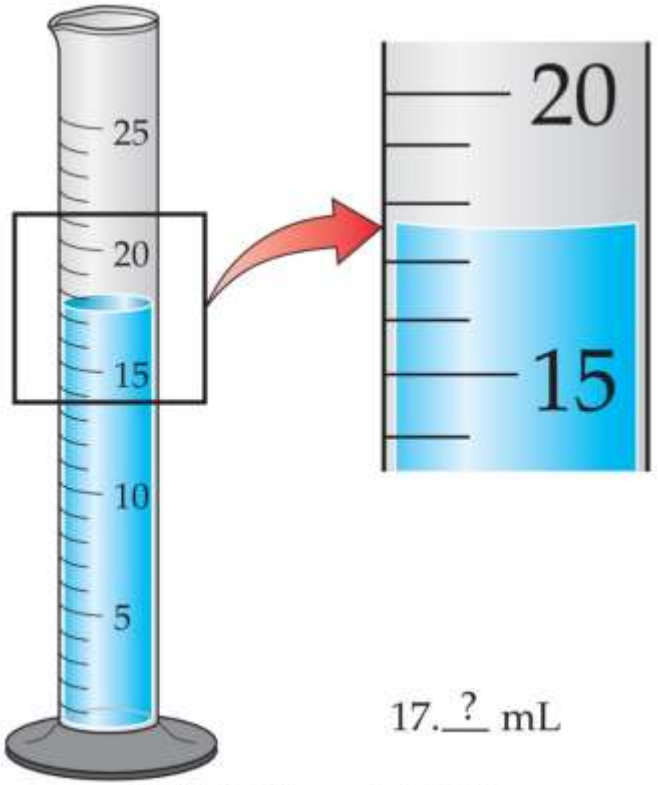
1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Uncertainty in measurements: When measuring, always estimate ONE place past the smallest mark





4 Evaluate based on A&P

3 Distinguish A&P in data

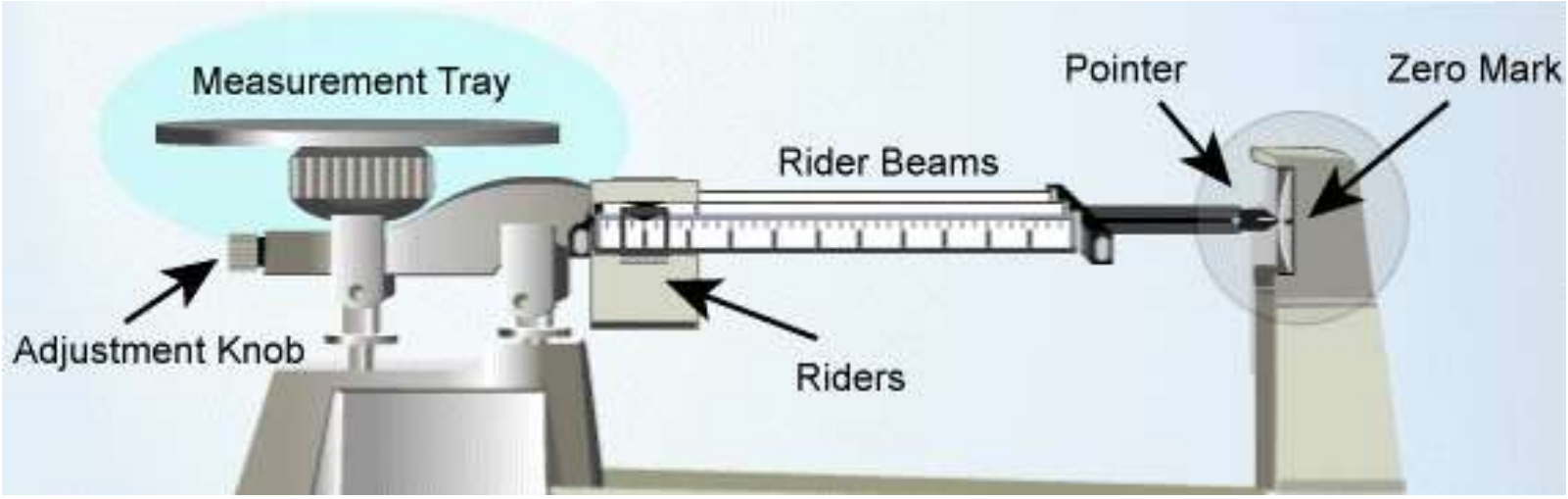
2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Triple Beam Balance



4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Zero Balance

1. Move all three sliders so that they read 'zero'.

- **Make sure that there is nothing on the pan and that it is clean.**
- **Check to see if the balance reads zero.**

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Balance Setup

2. Your balance isn't reading zero so you need to turn the thumbscrew to adjust the balance until it reads zero

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Balance Setup

- **Your balance is ready to measure. Place object to be weighed on the pan. Make sure that no part of the object is supported by the table.**

4
Evaluate based on A&P

3
Distinguish A&P in data

2
Importance of A&P

1
Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Moving Sliders

3. Start with the largest slider. Move the slider until balance tips, move the slider back to the previous position, move to the next slider.

4. Continue until the final slider until the balance reads zero.

4
Evaluate based on A&P

3
Distinguish A&P in data

2
Importance of A&P

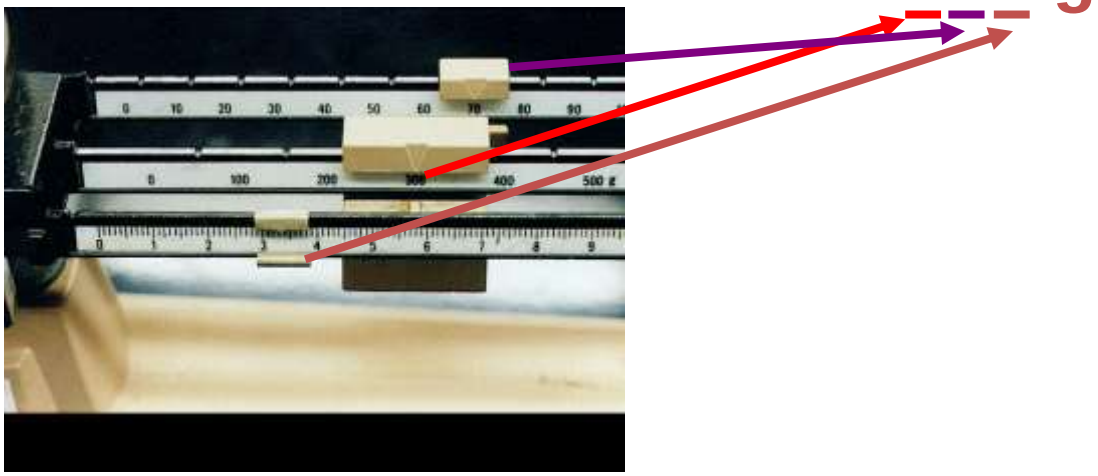
1
Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

5. Read each of the sliders and add their weights together.

The sliders indicate the mass is:



4 Evaluate based on A&P

3 Distinguish A&P in data

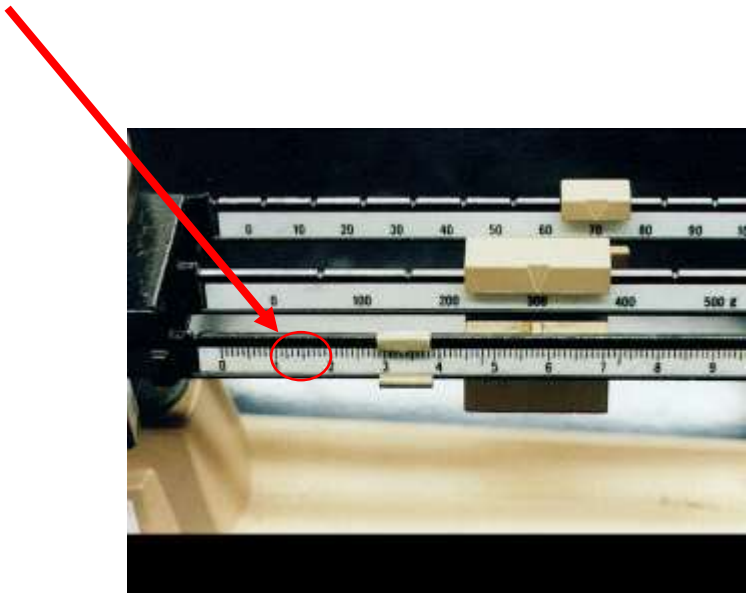
2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

When you read the last slider, notice that the smaller lines represent tenths.



4 Evaluate based on A&P

3 Distinguish A&P in data

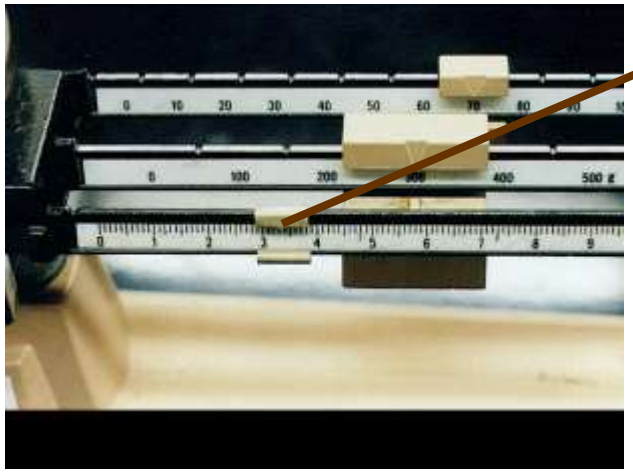
2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

This measurement is past the third line following the 3 on small slider. This indicates a mass of:



4 Evaluate based on A&P

3 Distinguish A&P in data

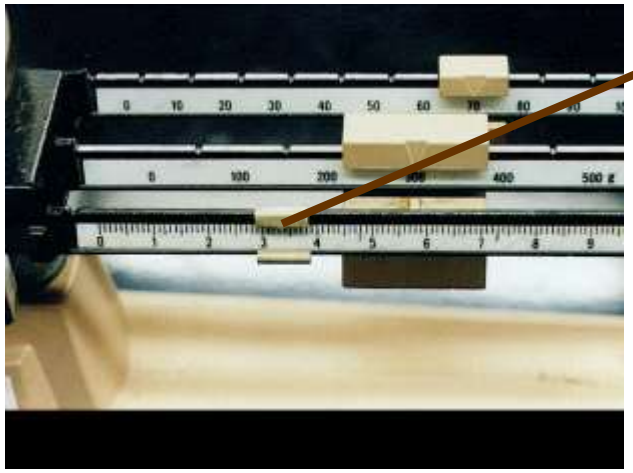
2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Uncertainty in measurements states we can estimate one past the lowest measurement. The number is halfway between 3.3 and 3.4, we record 3.35



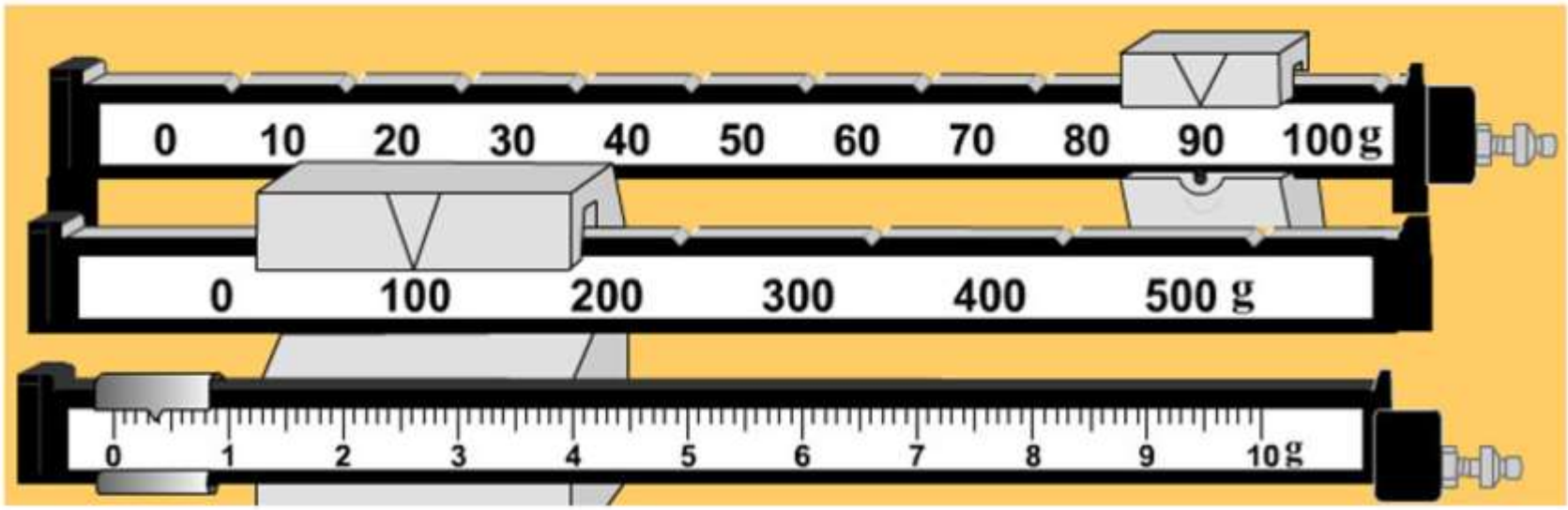
373.35 g

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

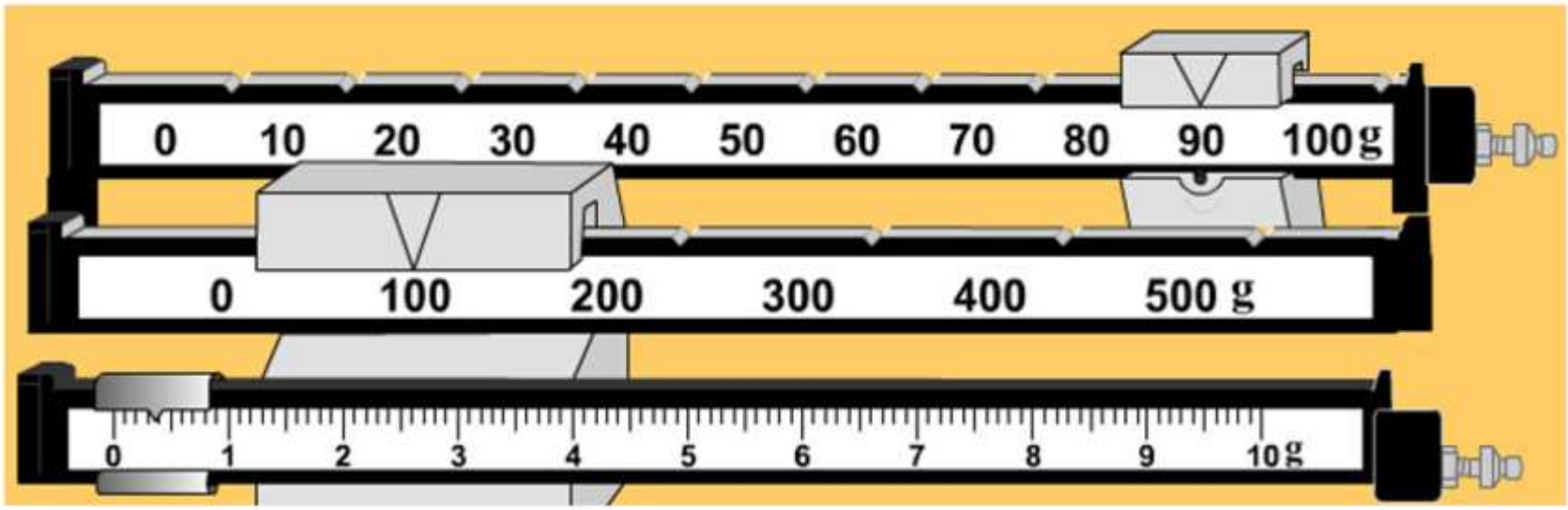
1 Define A&P



1. _____

100 + 90 + 0 + .3

Estimate .05



1. _____

190.35 g

Remember if it is right on the number add a zero (ex. 190.30)

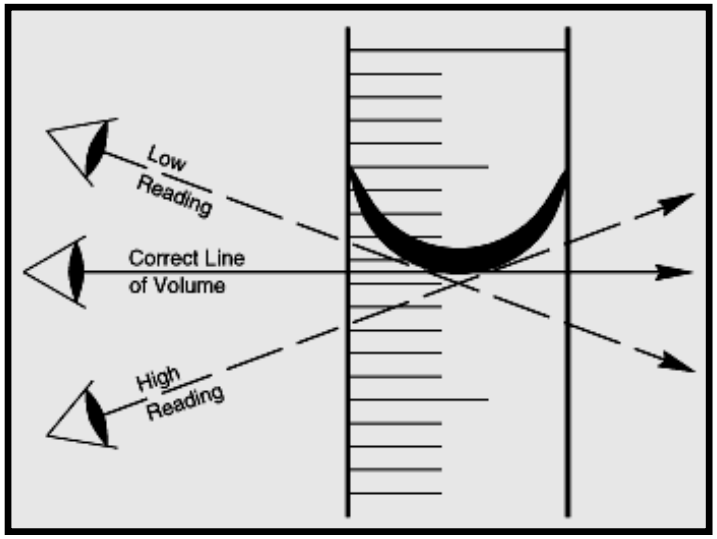
Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.

Reading the Graduated Cylinder

1. Read at eye level

2. Read to the bottom of the MENISCUS



4 Evaluate based on A&P

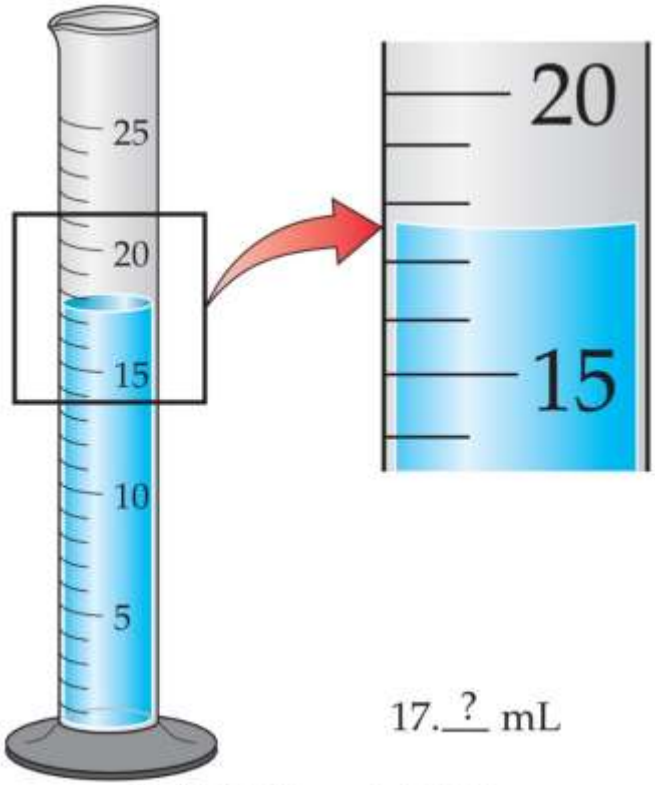
3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P

Investigative Science

Learning goal: Make accurate and precise measurements using proper significant figures when collecting and organizing data.



Smallest unit = ones place

= 17 ml

Estimate to the next mark… = tenths place

= 17.5 ml

If it is right on the number add a zero

Example, 15.0 ml

4 Evaluate based on A&P

3 Distinguish A&P in data

2 Importance of A&P

1 Define A&P