Unit 0 Prologue: Scientific Method

Name_____ Section_____

Statement of Inquiry: Changes (changing variables) lead to consequences that help us develop important principles and discoveries.

Approaches to learning:

- Collaboration
- Transfer Skills

Unit Outline:

1. Introduction to the Scientific Method
2. Writing Scientific Problems
3. Writing Scientific Hypotheses
4. Independent. Dependent and Controlled Variables
5. Data Collection and Analysis
    a. Why do we create graphs?
    b. Reading and interpreting graphs.
    c. Creating bar and line graphs
    d. Rulers
    e. Graduated Cylinders
    f. Digital Scales
6. Writing Scientific Conclusions (CER)
7. Designing your own experiment

Important Vocabulary:

Scientific Method. Problem. Hypothesis. Independent Variable. Dependent Variable. Controlled Variable. Constants. data table. line graph. bar graph. x-axis. y-axis. scale. graph title. legend/key. Metric system. ruler. graduated cylinder. meter. liter. gram. celsius. meniscus.. Conclusion

Academic Vocabulary

Determine. Interpret. Approximate. Data

Learning Goals:

- ❑ Students will be able to create and interpret line and bar graphs.
- ❑ Students will be able to understand the value of using the metric system.
- ❑ Students will be able to accurately use a metric ruler to record the lengths of objects.
- ❑ Students will be able to read and use a graduated cylinder to determine the volume of liquids
- ❑ Students will be able to find the mass of an object using a digital scale
- ❑ Students will learn how to use the steps of the scientific method to solve problems.
- ❑ Students will be able to write a scientific problem.
- ❑ Students will be able to write a scientific hypothesis.
- ❑ Students will be able to identify the difference between independent. dependent and controlled variables.
- ❑ Students will learn how to analyze data to draw conclusions.
- ❑ Students will be able to design and carry out their own experiment using the scientific method

LIVEWORKSHEETS

Name_____ Section_____

Scientific Method PRACTICE

Directions :

1. Read the **Skill Introduction: Scientific Method** on the other side.
2. Read **Mia's Experiment** below.
3. Try to decide which step of the scientific method each statement is describing in **Mia's Experiment.**
4. From the **Numbered list of scientific method steps** , use a pencil to write the number of the correct step on the line next to each of **Mia's Experiment** steps.

Numbered List of Scientific Method Steps

1. The problem
2. Gather information
3. A hypothesis
4. Test your hypothesis
5. Collect data
6. Analyze the data
7. Conclusion

Mia's Experiment

_____ Are hummingbirds attracted to the color red?

_____ "If I put bird food into different colored feeders, then more birds will eat out of the red feeder".

_____ Mia uses her textbook, the internet and her own observations to learn all that she can about hummingbirds.

_____ For a few days, Mia looks at each feeder and writes down all of her observations and creates a table that shows how much food each is eaten every day from each feeder.

_____ Mia places 4 different colored feeders outside in the same location and fills them with the same amount of food and same type of food.

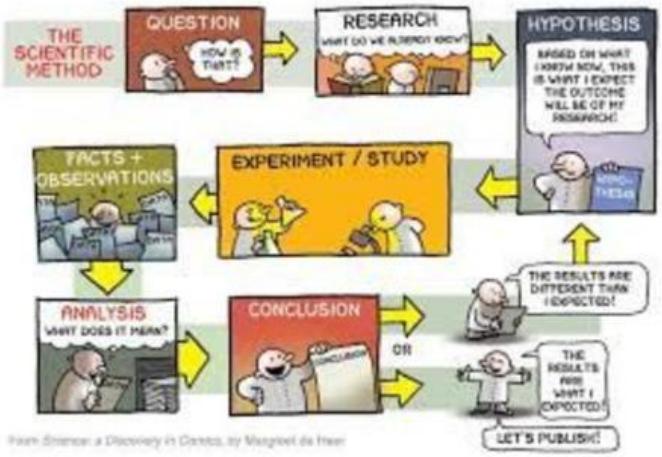
_____ After conducting her experiment Mia decides that hummingbirds are attracted to the color red.

_____ When Mia collects all of her data, she records it into a table and a graph.

LIVEWORKSHEETS

Word bank
collect
problem
conclusion
hypothesis
data
information
test

Scientific Method NOTES



1. **The** _____ (ask a question)

-written as a question

2. **Gather** _____

-may happen before you identify the problem as observations that you are making about something you don't understand

-may happen after you identify the problem as research on the internet, books or magazines to find out what is already known about the problem

3. **A** _____ (If..then…)

-written as an "If…,then…"statement

-needs to include the independent (manipulated) variable and dependent (responding) variable

4. _____ **Your Hypothesis**

-written as a numbered list

-must include the constants for the experiment

-should include a control group

- it's the experiment your are running

5. _____ **Data**

-should include a chart or table to record what was observed and measured in the experiment

6. **Analyze** _____ (graphic organizer or graphs)

-make sense of the observations by creating graphs and/or explaining patterns in the data

7. _____ (Summarize Results)

-Restate the problem

-State your hypothesis and whether or not your hypothesis was supported or not supported

-Use data from the experiment as evidence that shows whether not your hypothesis was supported

-Explain the evidence

-Concluding sentence

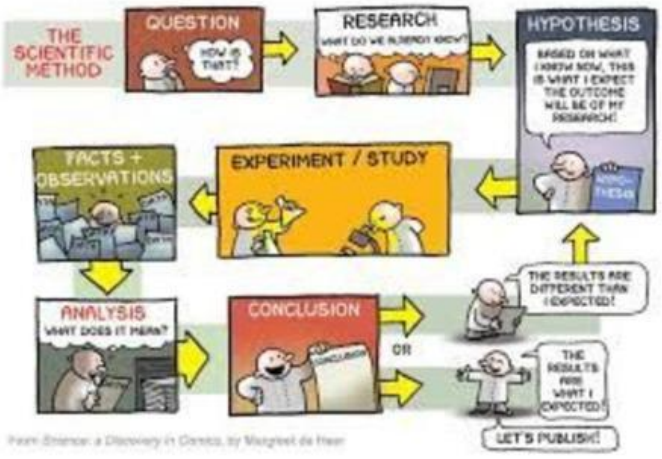
LIVEWORKSHEETS

Name:_____ Sec___

Scientific Method Practice

Select the correct letter from the Definition column to the correct vocabulary word column. Write the correct letter on the line next to the vocabulary word.

Vocabulary word	Definition
_____ Gather Information	A. The last part of the scientific method where you state your results saying if your hypothesis was supported or not
_____ Problem	B. Using graphs to organize and look closely at the results
_____ Hypothesis	C. An "If…, then…" statement that can be tested and is based on an educated guess
_____ Test your hypothesis	D. Writing down what you observe in the experiment
_____ Collect data	E. When you research information about the problem before you test your hypothesis
_____ Analyze data	F. Written as a question
_____ Conclusion	G. The experiment you run to see if your hypothesis was correct



LIVEWORKSHEETS

NAME_____ Sec_____

Problem NOTES

It is important to write out the problem that you are trying to solve. The problem has to be written as a question that can be answered with a possible solution. The problem has to be testable and cannot be based on opinion.

Word bank (1 word won't be used)
opinion
hypothesis
testable
question

Make sure it is:

- written as a _____
- has to be _____
- not written as an _____

Problem PRACTICE

Practice: *Place an X in the box next to the statement that best represents a problem a scientist could test based on the guidelines above.*	
	Which type of apple tree grows most quickly?
	Which type of apple tastes the best?
	Apple trees grow quickest during the fall.

	PROBLEM
Black Goo	1.
Color Goo	2.
Eggs	3.

LIVEWORKSHEETS

NAME_____ Sec_____

Hypothesis NOTES

The purpose of writing the problem as a question is so that you can try to come up with an answer or a possible solution. The possible solution is known as the hypothesis. The hypothesis should be written as an "If...then…" sentence.

Word bank (1 word won't be used)
opinion
if…then…
testable
question

Make sure it:

- is written as an _____ statement
- is _____

Hypothesis PRACTICE

Practice: *Place an X in the box next to all of the statements below that would represent a good hypothesis based on the guidelines above.*	
	The plant will grow taller when I give it water.
	If a plant gets more water, then the plants will grow taller.
	If aliens touch the plant, then the plant will grow taller.

	PROBLEM	HYPOTHESIS
Black Goo	**1.**	1.
Color Goo	**2.**	2.
Eggs	**3.**	3.

LIVEWORKSHEETS

Name_____ **Sec**_____

Variables and Constants NOTES

Word bank
measured
chooses
different
same

Independent (manipulating) variable:
What I (the scientist) _____ to test or change in the experiment

Dependent (responding) variable:
What is _____ or observed in the experiment

Constants (controlled variables):
The things that need to stay the _____ in the experiment

Variables and Constants PRACTICE

Select the independent variable in each experiment by placing an **"I"** on the line.
Select the dependent variable in each experiment by placing a **"D"** on the line.
Select the constant in the experiment by placing a **"C"** on the line.

1. Bill is doing an experiment to compare **how much water a plant needs to grow the tallest.**

   _____ **height of the plant**

   _____ **amount of water**

   _____ **type of plant**

2. Dot is doing an experiment to compare **how much sunlight a apple tree needs to grow the most fruit.**

   _____ **number of fruit grown**

   _____ **type of tree**

   _____ **amount of light**

2. Don is doing an experiment to compare **how much heat a bean seed needs to start growing.**

   _____ **amount of heat**

   _____ **time it takes to start growing**

   _____ **type of seed**

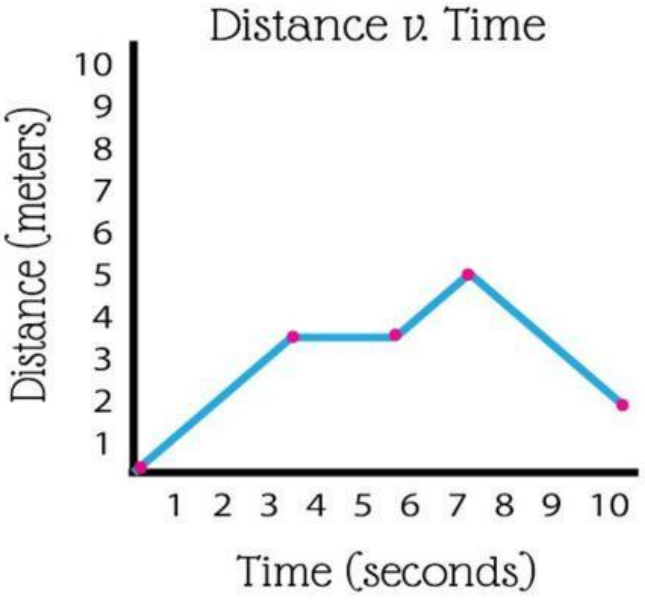
LIVEWORKSHEETS

Name_____ **Sec**_____

Graphing NOTES: Line Graph vs Bar Graph

DID YOU KNOW?
Graphs and charts are great because they communicate information visually. For this reason, graphs are often used in newspapers, magazines and businesses around the world. Sometimes, complicated information is difficult to understand and needs an illustration. Other times, a graph or chart helps impress people by getting your point across quickly and visually.

Word bank
changes over time
comparing amounts/quantities



Line Graph

-should be used to look for...

Example:
The line graph on the left shows how distance is changing over a period of time.

You can tell that at the beginning the distance increases, then in the middle the distance stays the same, then finally in the end the distance decreases.

Bar Graph

-should be used when...

Example:
The bar graph on the left compares how much trash is collected based on the 4 different kinds of trash.

You can tell that plastic was the most collected trash and wood was the least.

LIVEWORKSHEETS

Word bank

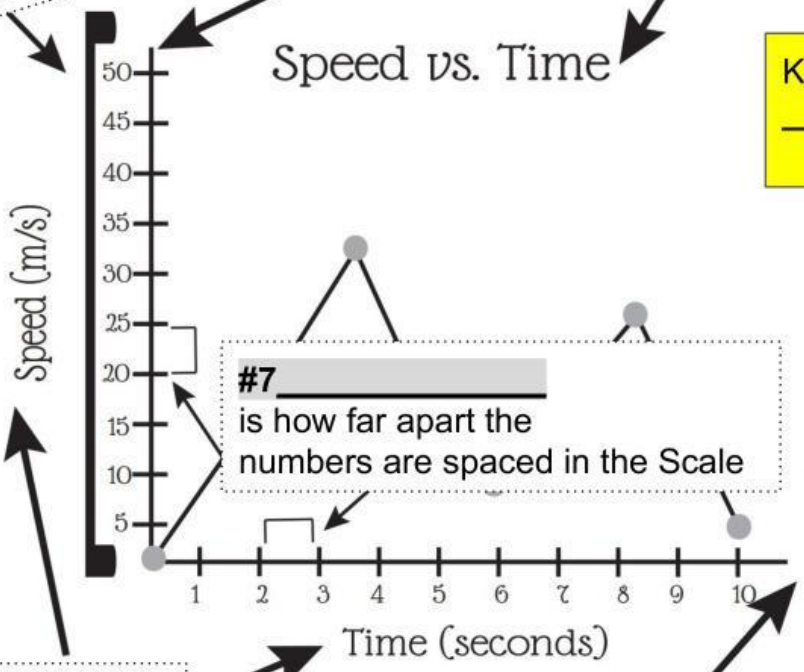
Intervals	Title
Labels	Units
X-axis	Y-axis
Scale	

Graphing NOTES: Parts of a Graph

#1_____
represents the range of numbers and must be evenly spaced, similar to how a ruler is set up

#2_____
dependent/responding variable
(what is being measured)

#3_____
is a combination of the x-axis label and y axis label



Key:
____ = black car

Key
is used to help identify different data in a graph

#7_____
is how far apart the numbers are spaced in the Scale

#4_____
names what the variables are on the x and y axis.

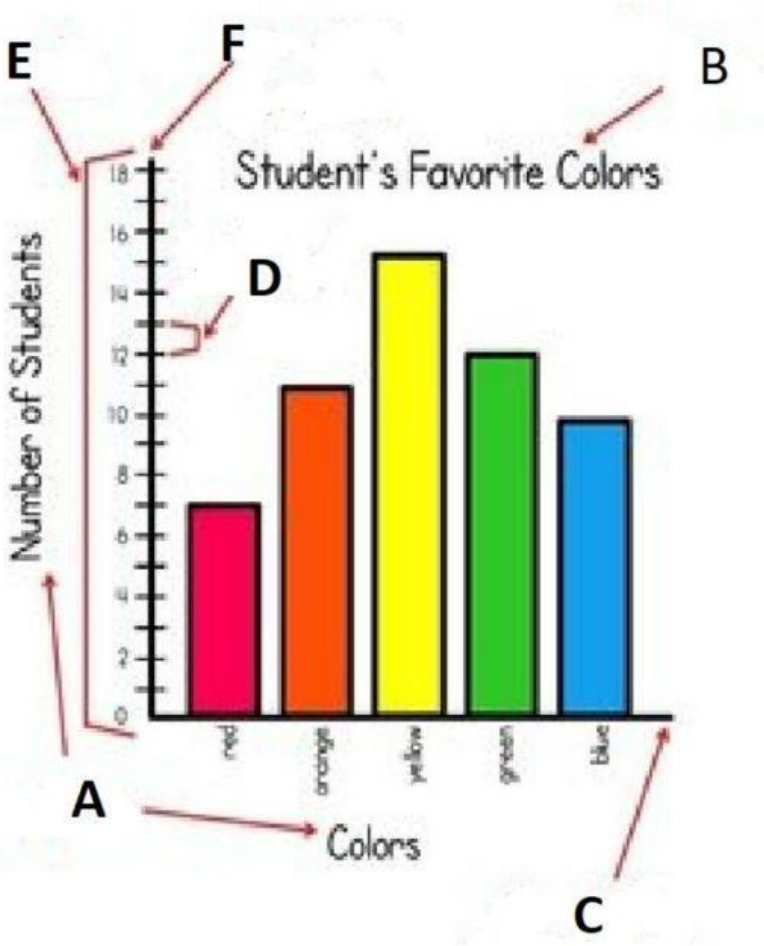
#5_____
identifies the value of the numbers being used

#6_____
independent/manipulated variable

LIVEWORKSHEETS

Graphing PRACTICE

Directions: Match the letter of each part of the graph with the correct name.	
Name	Letter
title	
label	
x - axis	
y - axis	
interval	
scale	



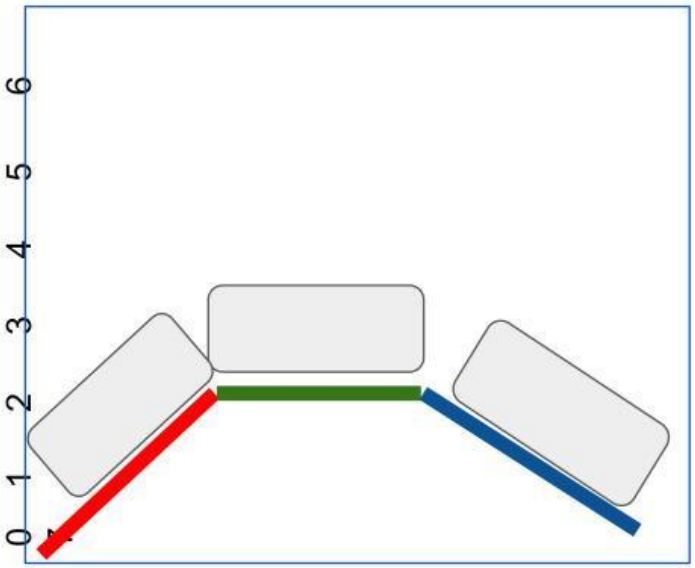
Directions: Read each description and circle if it should be a line graph or bar graph			
Description of data	**Line Graph**	**or**	**Bar Graph**
Number of trees in a park	Line Graph	or	Bar Graph
Hours worked per week	Line Graph	or	Bar Graph
Most popular types of pizza	Line Graph	or	Bar Graph
Favorite pet	Line Graph	or	Bar Graph
Height of plant growth for January	Line Graph	or	Bar Graph
Temperatures in NYC from 2016-2018	Line Graph	or	Bar Graph

LIVEWORKSHEETS

Word bank
-stay the same
-decrease
-increase

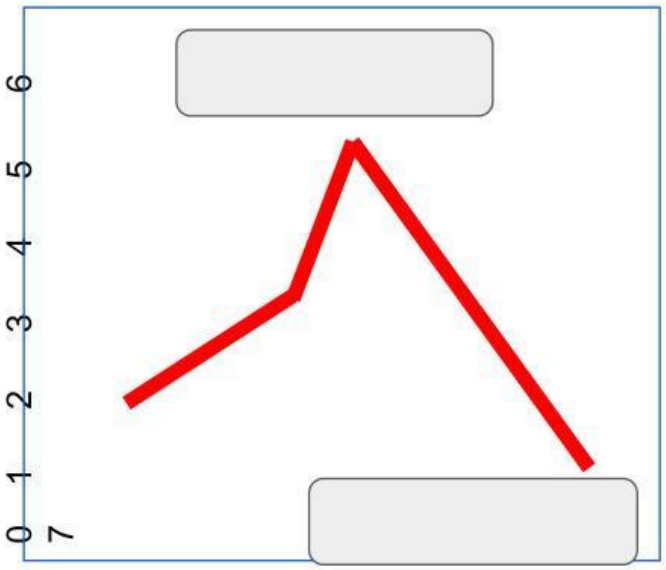
Interpreting Graphs NOTES

Graph A



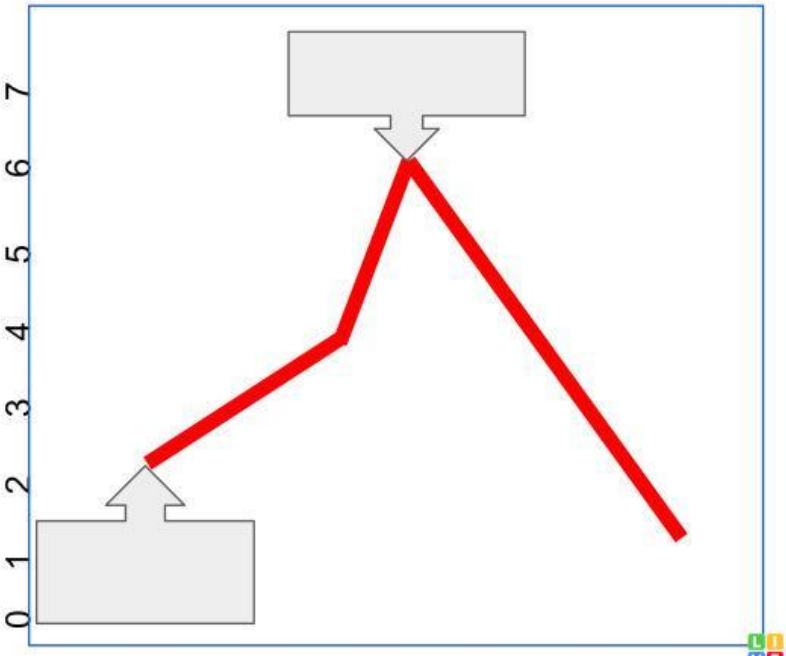
Word bank
-least/lowest
-greatest/highest

Graph B



Word bank
-starting to decrease
-starting to increase

Graph C



LIVEWORKSHEETS

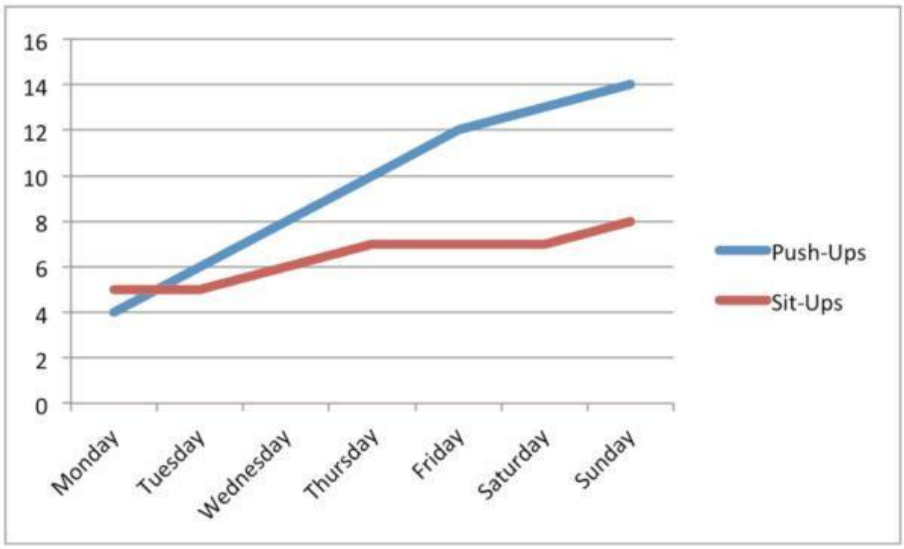
Interpreting Graphs PRACTICE

Graph A

1.What day did they do the greatest/highest number of pushups?

2.What day did they do the least/lowest number of situps?

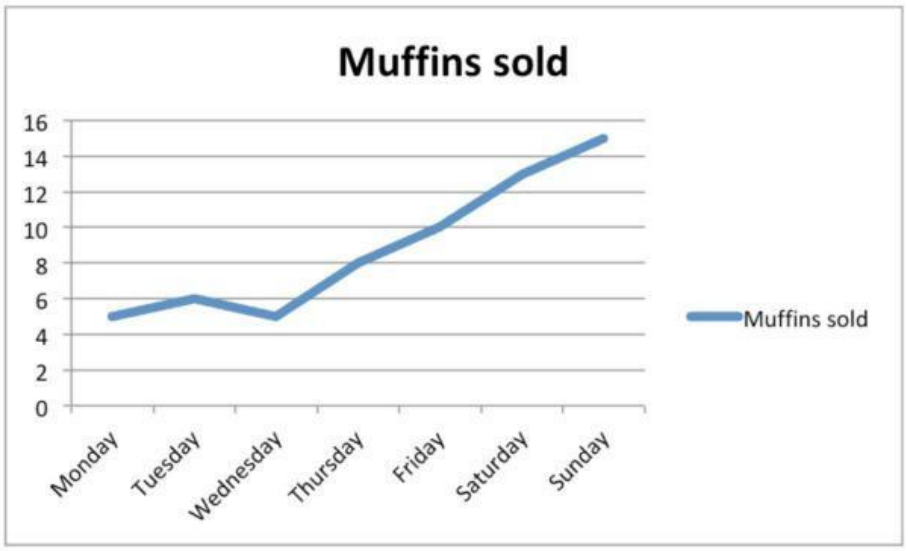
3. What 3 days did they do the same number of situps?



GraphB

1.What day did the muffin sales start to decrease?

2.After Monday,what day did the muffin sales start to increase?

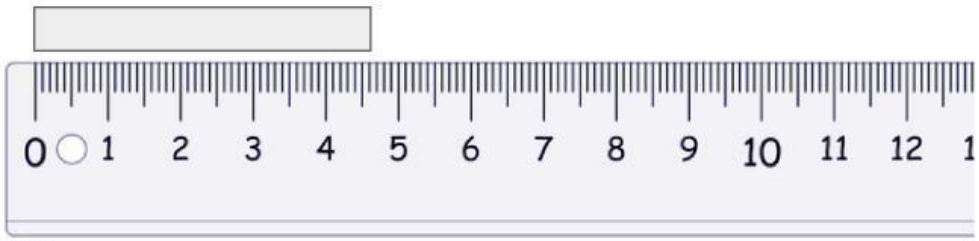


LIVEWORKSHEETS

Measuring Length using a Ruler in Millimeters (mm) NOTES

-always start at "0" on the ruler
-the space between each line is 1 mm
-there are 10mm between each long, numbered line
-the medium sized line shows 5mm
-find the length by counting each space, from the beginning to the end of the object
-when you record the length of an object in mm, you are recording it to the nearest whole number (ones place)

EXAMPLE:



_____ _mm

PRACTICE:

_____mm

_____mm

_____mm

_____mm

LIVEWORKSHEETS

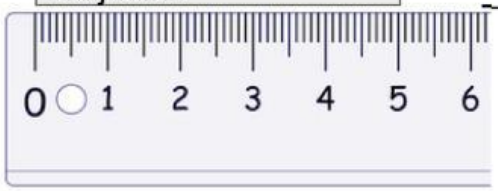
Measuring Length using a Ruler in Centimeters (cm) NOTES

-always start at "0" on the ruler
-the space between each line is 0.1 cm
-there is 1 cm between each long, numbered line
-the medium sized line shows 0.5cm
-find the length by counting each numbered line, from the beginning to the end of the object

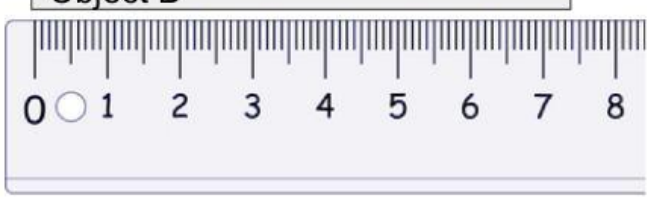
- OBJECT A: If the object ends on a long, numbered line then record that number and add .0 to the end of the number to show the tenths place value is 0
- OBJECT B: If the object ends past a long, numbered line then record that number, add a decimal, and then count and record the number of tenths past the numbered line

-when you record the length of an object in cm, you are recording it to the nearest tenths place (0.1)
EXAMPLES:

Object A ___cm



Object B ___cm



PRACTICE:

_____cm

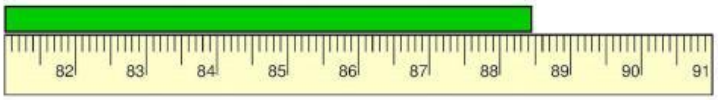
_____cm

_____cm

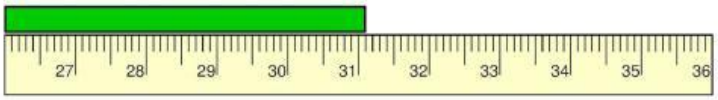
LIVEWORKSHEETS

Measuring Length using a Ruler PRACTICE

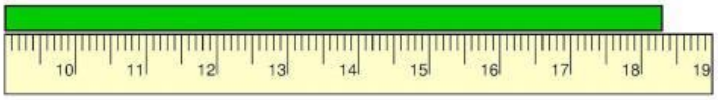
Directions: Measure and record the following lines in millimeters.



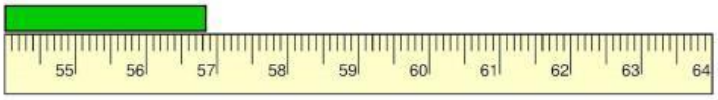
_____



_____

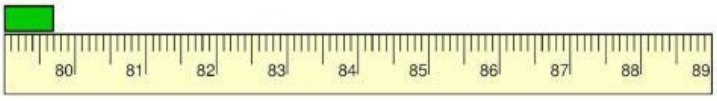


_____

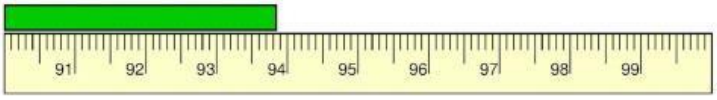


_____

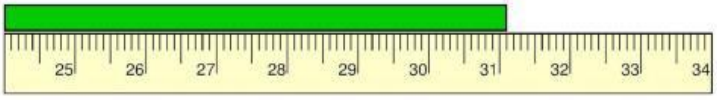
Directions: Measure and record the following lines in centimeters.



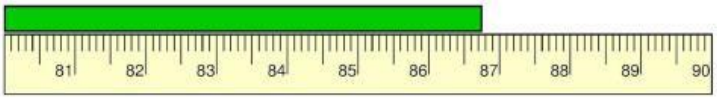
_____



_____



_____



_____

LIVEWORKSHEETS