CHAPTER 1
WHAT IS PHYSICS?

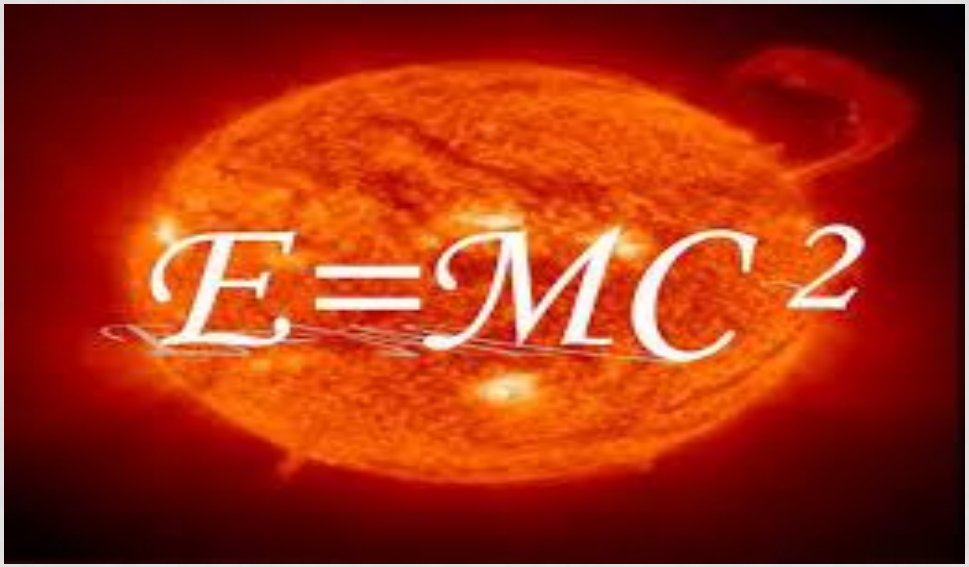
1.1 MATHEMATICS AND PHYSICS

PHYSICS

- A branch of knowledge that involves the study of the _____(from _____ to the _____).

MATH IN PHYSICS

- Equations are used to model _____ and make _____.

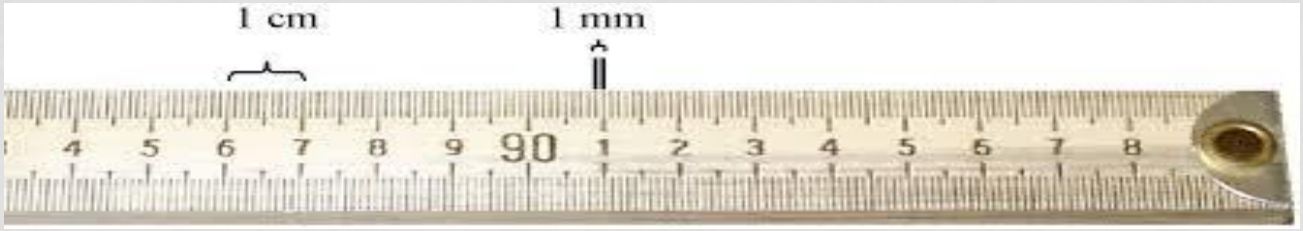


SI UNITS

- In order to effectively communicate results, scientists need a _____system of measurements.
- _____ (SI)
  - A convenient set of _____ measurements related by _____
  - Scientific institutions have defined and regulate measures
  - See Handout/Textbook

THE METER IS DEFINED AS:

- 1/10,000,000 of the distance form the _____ to the _____.
- Distance between 2 lines engraved on a _____ bar in Paris.
- Distance traveled by light in a _____in 1/299,792,458 seconds.



THE SECOND IS DEFINED AS:

- 1/86,400 of the average solar _____.
- Frequency of the _____emitted my a cesium atom.

THE KILOGRAM IS DEFINED AS:

- Mass of a small platinum-iridium metal cylinder kept at a controlled _____ and _____.

DIMENSIONAL ANALYSIS

- A method of treating units as algebraic quantities, that can be _____.
  - Use to see what your final unit should be.
  - EX:

CONVERTING UNITS

- Multiply by a form of one to change the _____ but not the _____.
  - Convert to base unit first:_____
  - Put the _____with the _____
  - Units in "opposite locations" cancel

EX: CONVERT

- 5.9 km to m
- 47.8 pm to mm
- 5.56 ng to kg

SCIENTIFIC NOTATION

- A way to write really _____numbers.
- Writes numbers as powers of 10.
- EX: 1,700 =
- EX: 0.0000079 =
- Make sure you know how to use scientific notation on your calculator.

SIGNIFICANT DIGITS

- The _____in a measurement (last digit for any given measurement is the uncertain digit).
  - Numbers believed to be correct
- Rules:
- 1) _____ digits are always significant.
  - EX: 8.954 = 4 sd
- 2) All _____ after the decimal are significant.
  - EX: 5.3331000 = 8 sd
- 3) _____ between 2 other sig digs are always significant.
  - EX: 809.07 = 5 sd
- 4) Zeros used solely as _____ are not significant.
  - EX: 0.00000000005 = 1 sd

SIGNIFICANT DIGITS

- Scientific notation can help clear up any ambiguity when it comes to determining how many significant digits a value has.
- EX: 184, 000could have 3,4,5, or 6 sd.
- 1.84000×10^6 has 6 sd

STATE THE NUMBER OF SIGNIFICANT DIGITS IN EACH:

- 3021
- 7.8×10^5
- 7.08×10^5
- 7.80×10^7
- 0.0000007021
- 59.0000

- Determining the correct number of sd after performing a mathematical operation:
  - Add/Sub – least _____ number
  - EX: 5.12 cm + 6.129 cm

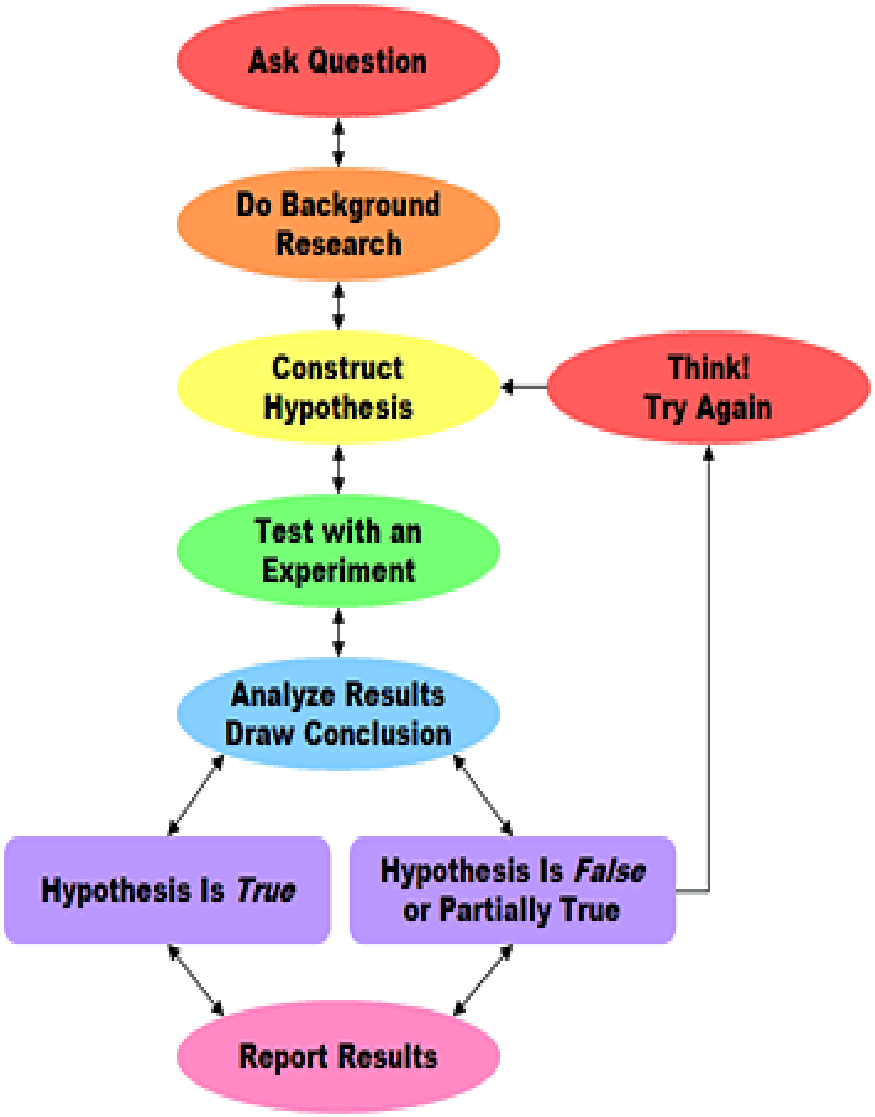
  - Mult/Div – least number of _____
  - EX: 12.78 m x 1.23 m

A = 1.24 M B = 0.23 CM

- Which has more sig digits?

- Which is more precise?

A SCIENTIFIC METHOD:

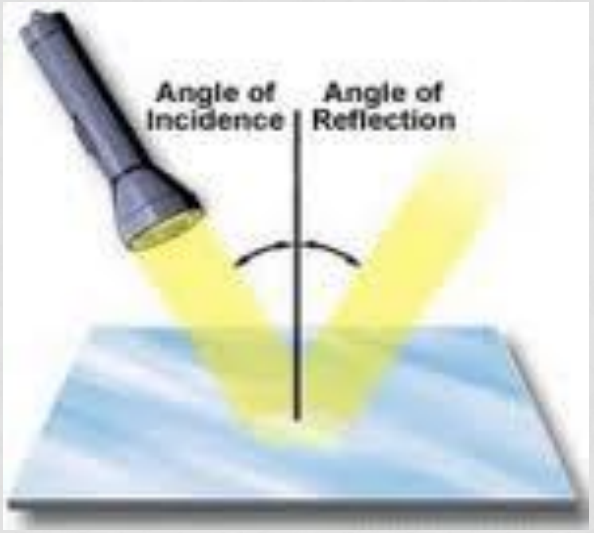


SCIENTIFIC METHOD

- Experiments/Results must be _____.
  - Other scientists must be able to _____ the experiment with similar results

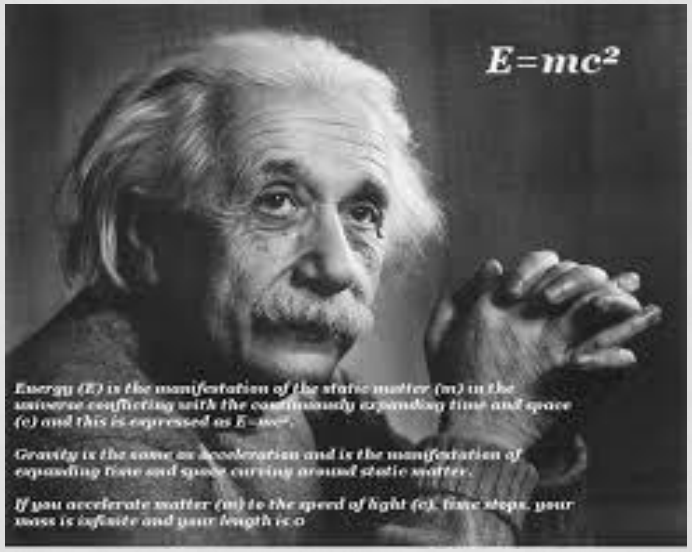
SCIENTIFIC LAW

- A rule of nature that sums up _____ to describe a _____.
- Laws only describe _____ happens – not _____ they happen.
- EX: Law of Reflection – angle of incidence equals the angle of reflection.



SCIENTIFIC THEORY

- An _____ based on many observations supported by _____.
- Best available _____for why things happen the way they do.
- EX: Einstein's Theory of Relativity



1.2 MEASUREMENT

MEASUREMENT

- A comparison between an _____ quantity and an _____standard.
  - EX: You measure your desk with a meter stick.

- Many measurements contain a certain amount of _____
  - A new measurement within the margin of uncertainty _____ the old measurement .

COMPARING RESULTS AND UNCERTAINTIES

- Three students measure the length of a model car:
  - Student 1 average: 18.8 ± 0.3 cm
  - Student 2 average: 19.0 ± 0.2 cm
  - Student 3 average: 18.3 ± 0.1 cm
- Which are in agreement?

- Which are not in agreement?

PRECISION

- The degree of _____ of a measurement.
  - When dealing with multiple measurements, the smaller the variation between them, the more precise they are. (small ±)
- Which student was most precise?

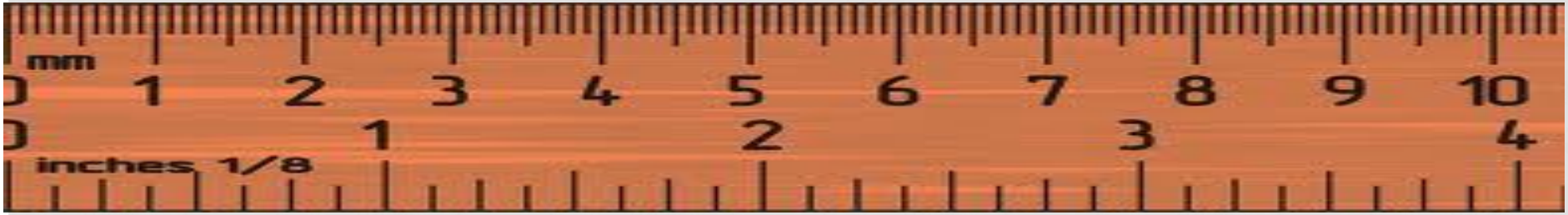
- Which was least precise?

PRECISION

- To get a precise measurement, use a tool with the _____ divisions possible.
- This will allow your measurement to be taken out to more _____.

PRECISION

- Always measure to the _____ and then _____ the last digit.
  - A measurement can never be more precise _____ used to measure it.
  - EX:
- The precision of a measurement is said to be ___ the smallest division of the tool.
  - Meter stick: _____divisions
  - Max range of error based on tool: ± _____



ACCURACY

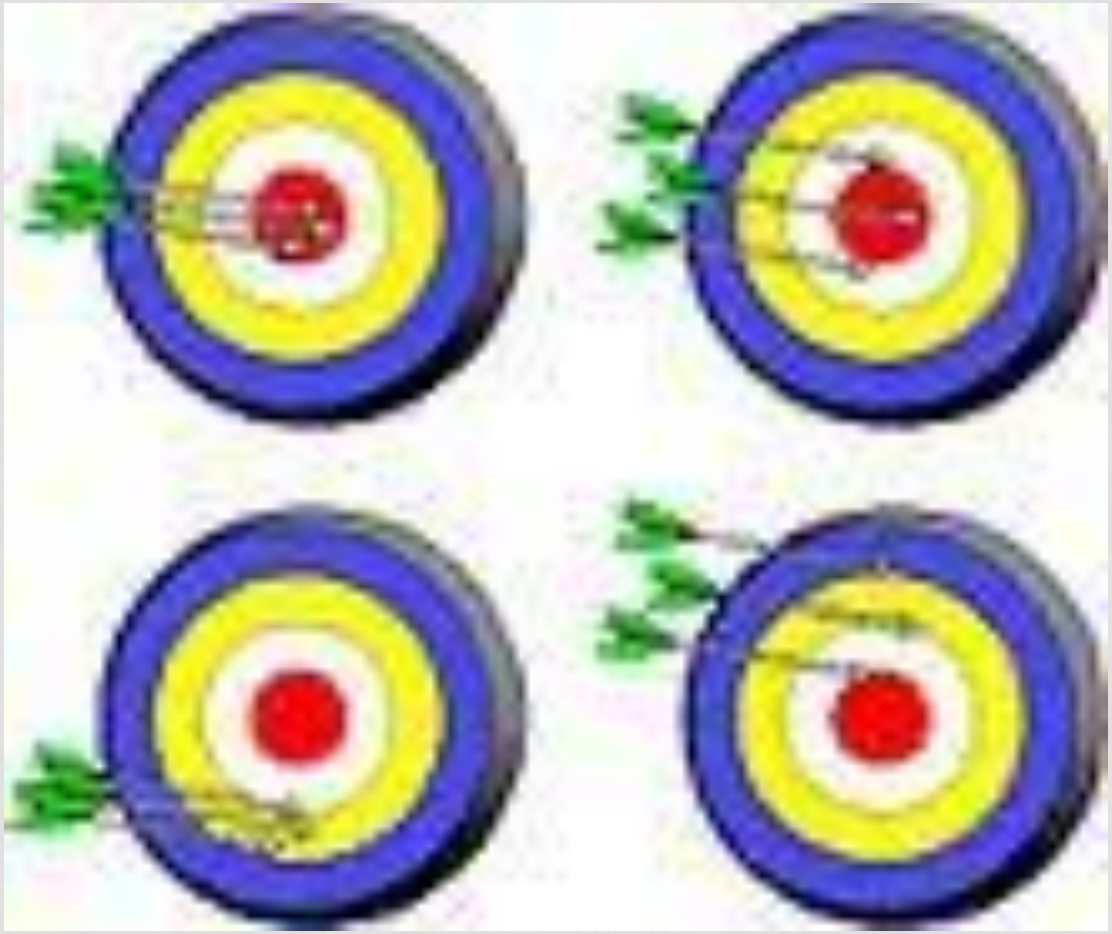
- How well the results of an experiment agree with the _____ ("real") value.
- If the model car was actually 19.0 cm, which student was most accurate?

- Which was least accurate?

ACCURACY

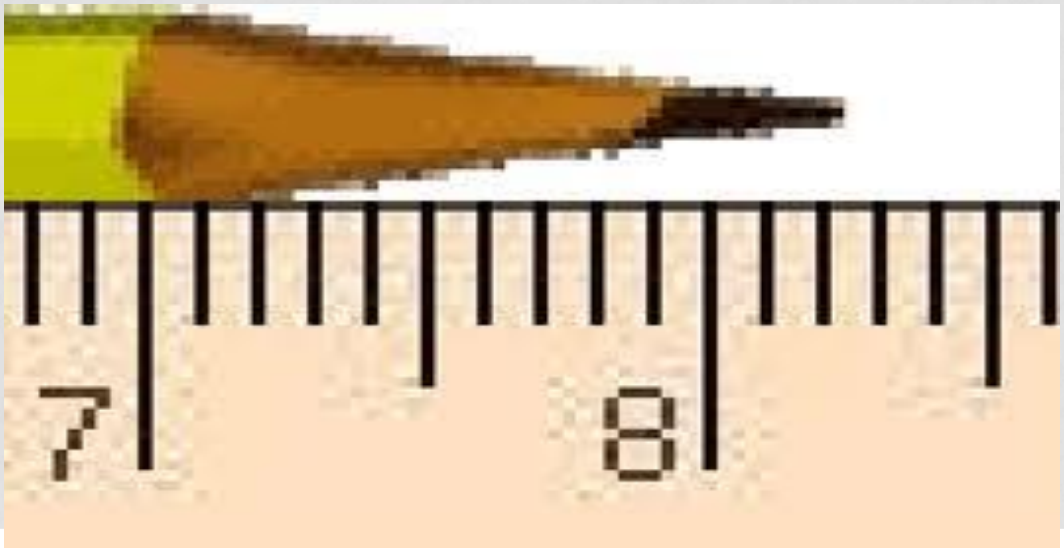
- To make sure a measuring tool is accurate (even if it is precise), it must be _____.
  - Make sure it reads _____ when it should.
  - Make sure it gives the correct reading when measuring an _____standard.

PRECISION VS ACCURACY



PARALLAX

- The apparent _____ in the position of an object when it is viewed from different _____.
  - Pay attention to the _____ at which you are reading a measurement. Read it from _____.



1.3 GRAPHING DATA

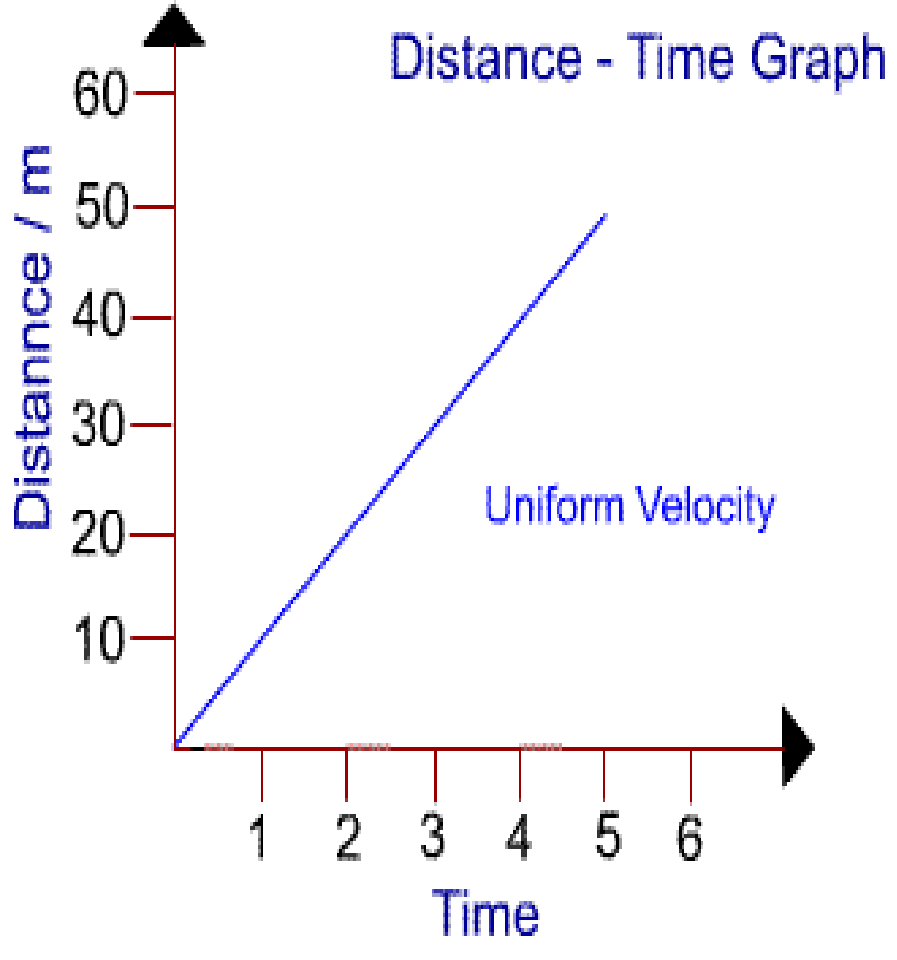
- Independent Variable – the variable that is _____. The experimenter controls it directly.
- Dependent Variable – depends on the _____variable.

WHEN PLOTTING DATA:

- 1) Identify the independent and dependent variables.
  - Plot the independent variable on the horizontal _____ axis.
  - Plot the dependent variable on the vertical _____ axis.
- 2) Determine the _____ of the data and divide your axis accordingly.
- 3) Plot the data points and draw in the _____ line/smooth curve.
- 4) _____ and _____ the graph.

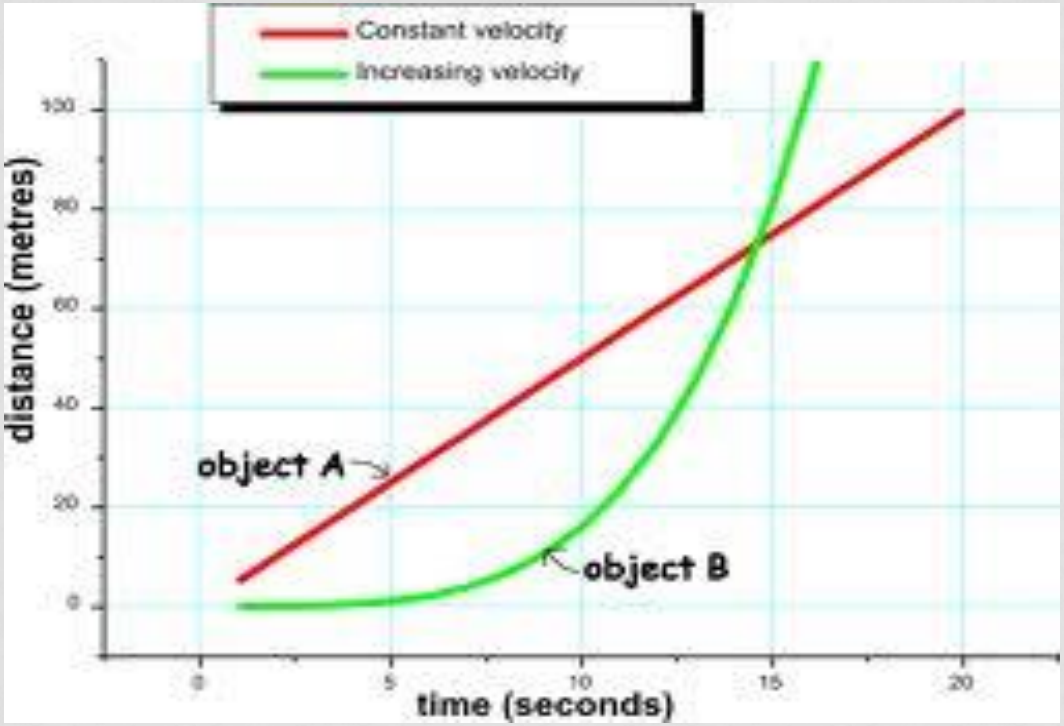
LINEAR RELATIONSHIPS

- A straight _____ graph.
- Variables are _____ proportional.
- Equation:
  - Pay attention to the _____of the slope.
  - It often represents a _____.



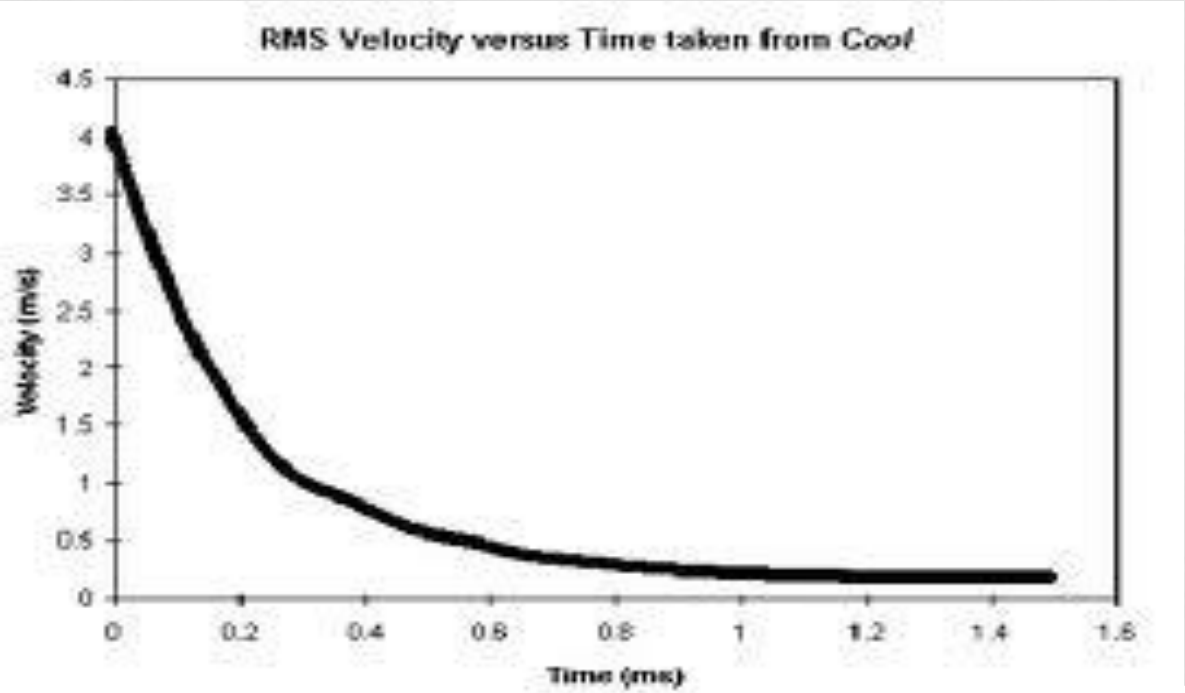
QUADRATIC RELATIONSHIP

- Graph is a _____.
- One variable depends on the _____ of the other.
- Equation:



INVERSE RELATIONSHIP

- Graph is a _____.
- One variable depends on the _____ of the other.
- Equation: , where "a" is a constant.



- You can use graphs to make _____.
- Make sure your predictions are within reason.
- EX: Graphing length of a spring for different masses.
  - What limitations to prediction are there?