

WELCOME!

PLEASE TAKE A FEW MINUTES TO ANSWER THESE QUESTIONS ON THE INDEX CARD. YOU MAY USE THE FRONT AND BACK. I WILL COLLECT THEM AT THE END OF CLASS TODAY.

1) WHAT IS ONE FUN THING  
YOU DID OVER THE SUMMER?

2) FILL IN THE BLANK:  
“I WONDER (ABOUT) \_\_\_\_\_.”





WELCOME TO GENERAL PHYSICS!



## GOALS FOR TODAY

- Answer the question “What is physics?”
- Go over classroom expectations
- Introduce some basics to physics
- Do your first physics problem!

# WHAT IS PHYSICS?

- A branch of science that explores the fundamental principles on which our world is built.
- Physics allows us to make conclusions about and predictions of what we cannot see based on what we can see.



# HOW DOES PHYSICS MATTER?

- If you live in this world, physics very likely applies to you!
- You will be able to ask, answer, and effectively explain some (possibly silly) questions like:
  - Does Ash Ketchum from Pokemon have super strength?
  - How much Force did Yoda use to lift the X-Wing in *Empire Strikes Back*?
  - How do you turn a rocket in space?
  - Is light speed travel possible?
  - Why does the moon look huge and yellow-ish sometimes?
  - ...any many other questions you may wonder about!

The background is a dark blue gradient with a subtle pattern of white stars and technical diagrams. On the right side, there are several circular diagrams with concentric lines and arrows, resembling a gauge or a control panel. One of these diagrams has numerical markings from 0 to 210. There are also some dashed lines and arrows scattered across the background, suggesting motion or a technical process.

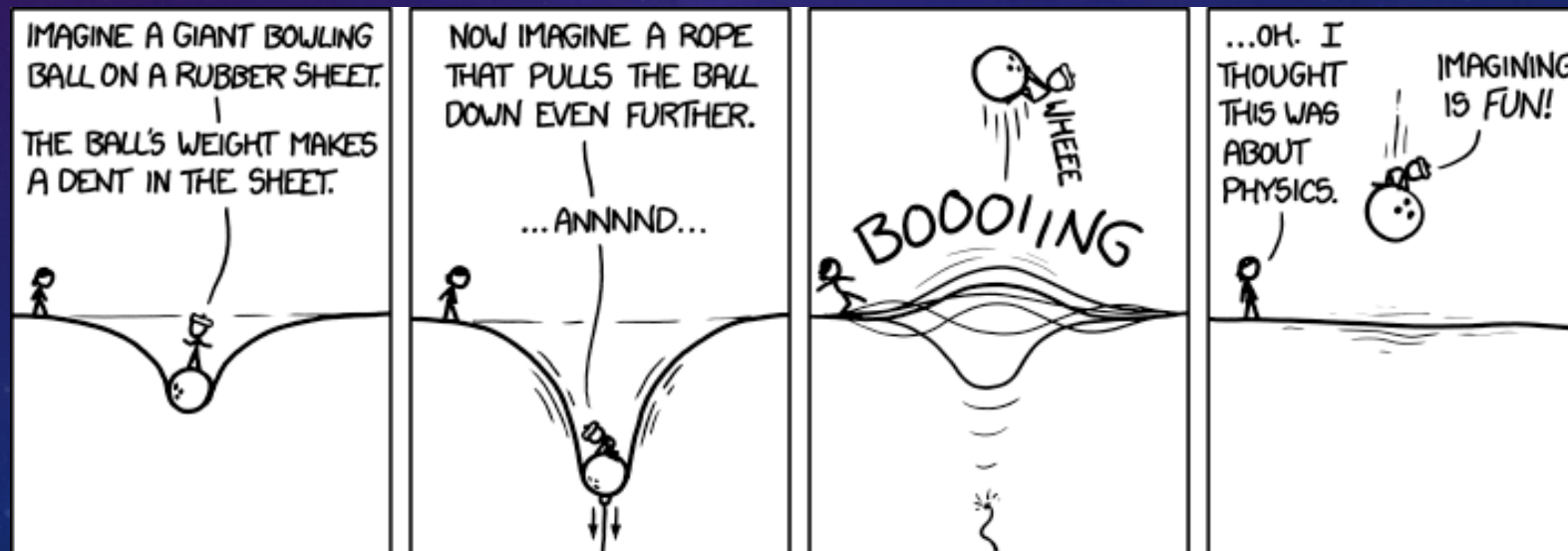
# BASICALLY, PHYSICS WILL CHANGE HOW YOU SEE THE WORLD!

GET READY BECAUSE YOUR MIND WILL BE BLOWN.



GREAT, SO HERE'S HOW TO GET THE MOST OUT OF THIS CLASS.

- <http://robertsonphysics.weebly.com/>
- Most of all, ask questions and imagine!



# THE MOST FUNDAMENTAL OF FUNDAMENTALS

A REVIEW OF S.I. UNITS, SIGFIGS, AND SCIENTIFIC NOTATION



# S.I. UNITS

- Length – meter (m)
- Mass – kilogram (kg)
- Electric current – Ampere (A)
- Temperature – Kelvin (K)
- Time – second (s)
- And more that we'll go over later

# METRIC PREFIXES

PREFIX	SYMBOL	EXPONENTIAL
Tera	T	$10^{12}$
Giga	G	$10^9$
Mega	M	$10^6$
Kilo	k	$10^3$
Centi	c	$10^{-2}$
Milli	m	$10^{-3}$
Micro	$\mu$	$10^{-6}$
Nano	n	$10^{-9}$
Pico	p	$10^{-12}$



DO NOT FORGET TO  
CONVERT TO S.I.!

# Metric mishap caused loss of NASA orbiter

**September 30, 1999**

Web posted at: 4:21 p.m. EDT (2021 GMT)

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## In this story:

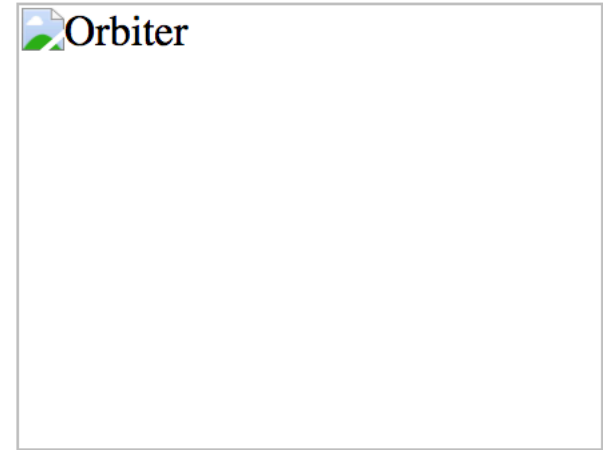
[Metric system used by NASA for many years](#)

[Error points to nation's conversion lag](#)

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By Robin Lloyd  
CNN Interactive Senior Writer



Orbiter

NASA's Climate Orbiter was lost September 23, 1999

(CNN) -- NASA lost a \$125 million Mars orbiter because a Lockheed Martin engineering team used English units of measurement while the agency's team used the more conventional metric system for a key spacecraft operation, according to a review finding released Thursday.

# CONVERTING UNITS

- 1 m = 100 cm = 1000 mm = 0.001 km
- 100 km/hr = ? m/s
  - $100 \frac{km}{hr} * 1000 \frac{m}{km} * \frac{1hr}{3600sec} = 27.7778 = \text{approx. } 30 \text{ m/s}$
- Pay attention to the units in the problem and the units asked for in the answer.



# SIGNIFICANT FIGURES

- The number of reliably known digits in a number
- Tells you how accurately you know a number
- You can say downtown LA is about 10 miles away vs. it's exactly 12.7 miles away
- Even more accurately, it might be 12.733 miles away?



# SIG FIGS

- 10 has one sig fig
- 12.7 has three sig figs
- 12.733 has five sig figs
- 0.0067 has only 2 sig figs
  - Zeros are only place holders to show where the decimal is.
- How many sig figs does 80.0 have? Why?
- How many sig figs does 60.7 have? Why?



# SIG FIGS IN CALCULATIONS

- **Multiplying and Dividing**
- **The answer should only have as many sig figs as the number with the least number of sig figs used in the calculation.**
  - Example – find the area of a rectangle with sides 11.3 cm and 6.8 cm
  - Your calculator will tell you  $76.84 \text{ cm}^2$ , but there is no way you know the area of that rectangle to  $0.01 \text{ cm}^2$ .
  - How many sig figs should your answer have?

# SIG FIGS IN CALCULATIONS

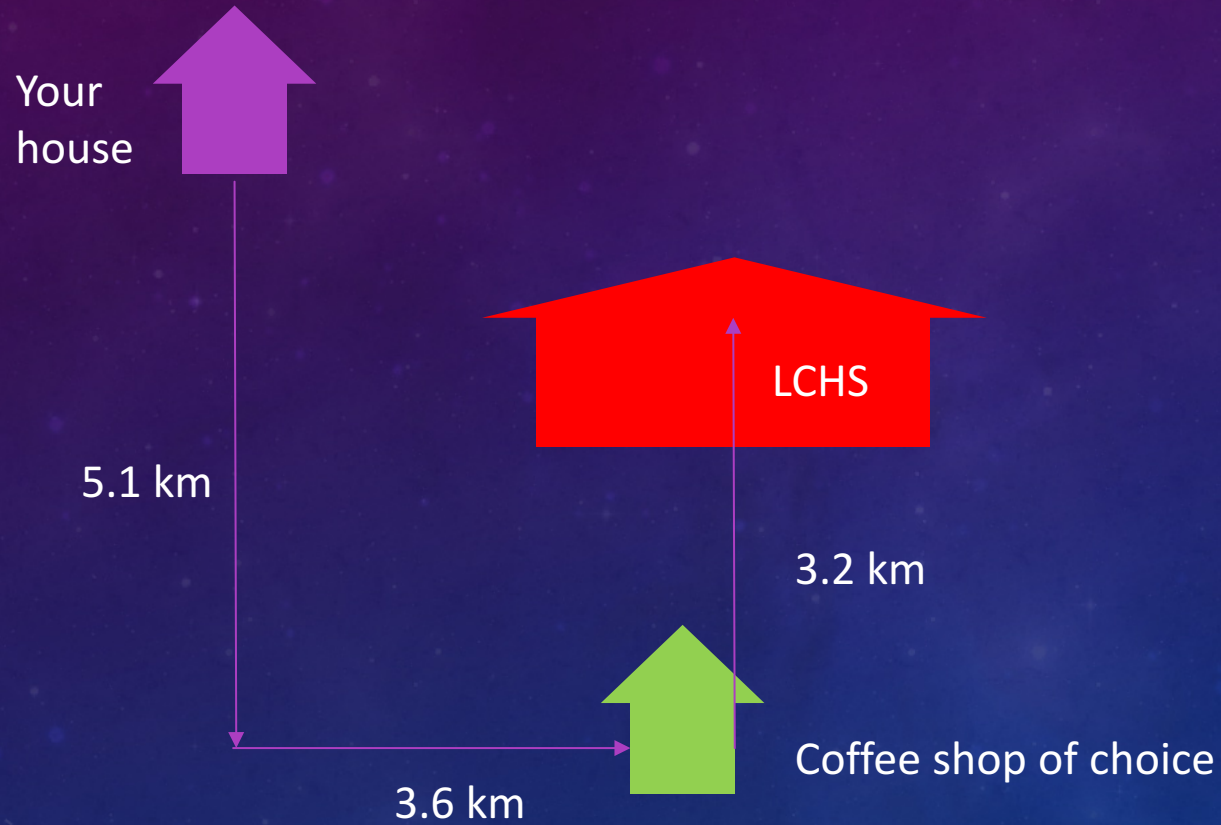
- **Adding and subtracting**
- **The answer can contain no more decimal places than the least accurate measurement.**
  - Example: you tie a 30.6 m rope to the end of a 0.57-long rope. How long are the two ropes together?
  - You will get 31.17 m, but round off to 31.2 m



# SCIENTIFIC NOTATION AND CALCULATIONS

- Instead of writing 1,540,000 m, write  $1.54 \times 10^6 m$ 
  - Side note – how many km is this?
  - $1.54 \times 10^6 m \times \frac{1 \text{ km}}{10^3 m} = 1.54 \times 10^3 m$
- Instead of 0.0000448 kg, write  $4.48 \times 10^{-5} kg$ 
  - Side note – how many g is this?
  - $4.48 \times 10^{-5} kg \times \frac{10^3 g}{kg} = 4.48 \times 10^{-2} g$

# DISTANCE VS. DISPLACEMENT – YOUR FIRST PHYSICS PROBLEM

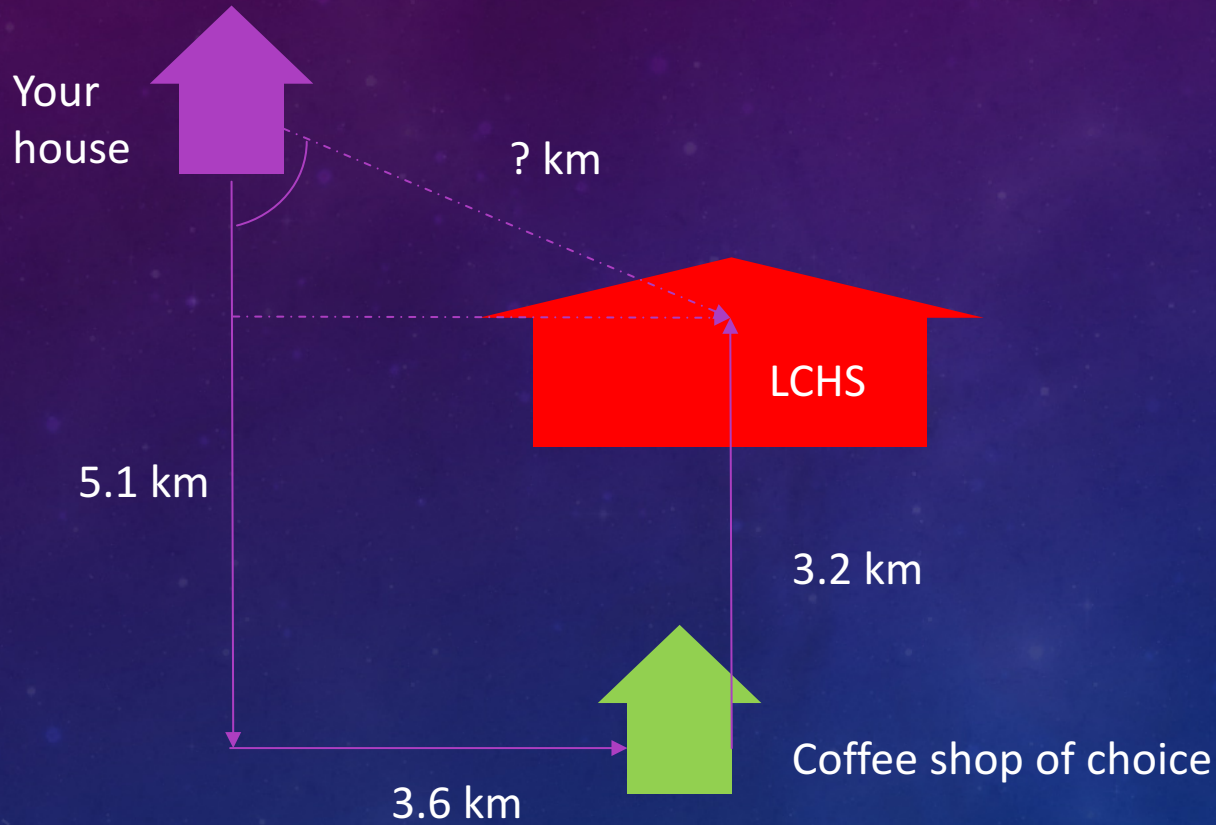


What was the **total distance** of your trip?

$$= 5.1 + 3.6 + 3.2 = 11.9 \text{ km}$$



# DISTANCE VS. DISPLACEMENT



What is the **distance** between your house and LCHS?

$$\sqrt{3.6^2 + 1.9^2} = 4.0706 \text{ km} \rightarrow 4.1 \text{ km}$$

What is the **direction** between your house and LCHS?

$$\tan^{-1}(3.6/1.9) = 62^\circ \text{ East of South}$$

Your **displacement** is 4.1 km 62° E of S (or 28° S of E)

After you do a physics problem, ask – does my answer make sense?





# SCALAR VS. VECTOR

- Scalars have only magnitude
  - Distance is a scalar
- Vectors have both magnitude and direction
  - Displacement is a vector

## SOME PRACTICE PROBLEMS

Sally runs twice around a 400m track. What is her total distance?

- a) 400m
- b) 800m
- c) 600m
- d) None of the above



## SOME PRACTICE PROBLEMS

Sally runs twice around a 400m track. What is her total displacement?

- a) 0m
- b) 800m
- c) 400m
- d) None of the above

## SOME PRACTICE PROBLEMS

Billy skateboards for 6.7 meters, then another 0.5 meter up a ramp, then coasts 2.0 meters backwards.

a) Draw a diagram of Billy's motion.

b) What is his distance traveled?

c) What is his displacement?



# SOME PRACTICE PROBLEMS

What is  $[3.0 \times 10^{-3}][2.0 \times 10^5]$ ? Make sure to have the correct # of sig figs.

## SOME PRACTICE PROBLEMS

What is  $4.50 \times 10^9$  ? Make sure to have the correct # of sig figs.

$$6.636 \times 10^{-5}$$



# CURB YOUR INTUITION

- Establish new points of reference for your brain
- Important to evaluate whether or not your answers make sense
- Instead of saying “1.8 m/s is about 4 mph”, say “that’s about jogging speed”



# CURB YOUR INTUITION

Temperature	Length/height/distance	Mass	Speed
60°C record high on earth	1 cm Width of microSD	3 g Peanut M&M	1.4 m/s Walking
45°C Heat wave in Dubai	3.5 cm length of 3DS game	100 g cell phone	1.8 m/s Jogger
35°C Pretty gross out	12 cm CD diameter	500 g Bottled water	4.3 m/s Biking speed
30°C Beach day	75 cm width of Captain America's shield	1.5 kg Chromebook	11 m/s School Zone
25°C Room temp	80 cm doorway width	2.8 kg physics textbook	36 m/s LA driver on freeway
0°C Snow	1m lightsaber blade	4 kg Cat	89 m/s Nascar speed
-10°C Cold day (Moscow)	229 cm height of Yao Ming	60 kg Lady	257 m/s Cruising plane
-40°C Spit freezes	3m 1 story building	70 kg Dude	340 m/s speed of sound
-50°C low for Minnesota	5m length of car	460 kg Snorlax	$3.0 \times 10^8$ m/s speed of light