Introduction to Physics

Name: _____

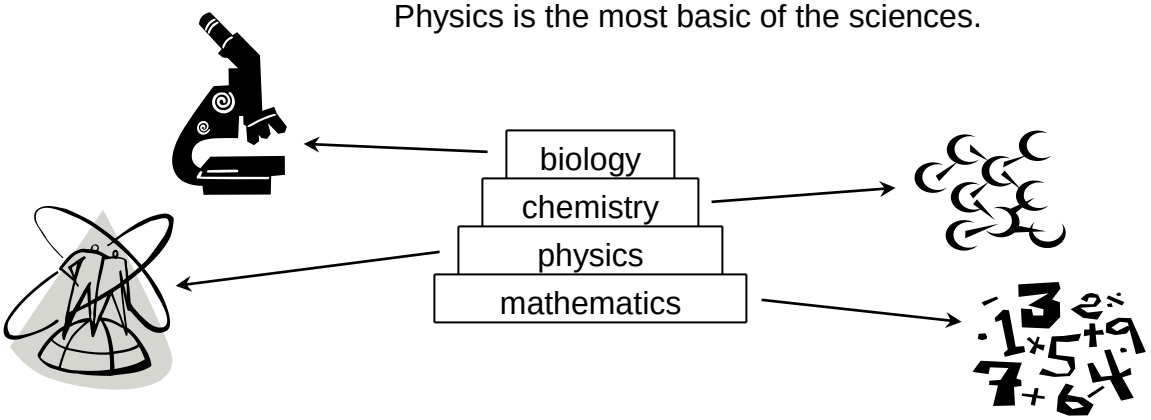
Video 103 (2:16)

Physics:

few concepts

few equations

Physics is the most basic of the sciences.



Video 106 (4:36)

Areas of Physics

Mechanics:

Vibrations and Waves

Optics:

Electromagnetism:

Relativity:

Quantum Mechanics:

Thermodynamics:

Video 109 (3:33)

The Nature of Science

Science vs. Religion?

<u>science</u>

investigates observable universe

<u>religion / philosophy</u>

deals with cosmic purpose

Pure Science vs. Applied Science

pure science:

-- facts

-- relationships between things

-- theories

applied science (technology):

-- tools

-- techniques

-- using science creatively

Law or Theory?

law:

theory:

e.g., conservation laws, gravity

e.g., combustion theory of burning, atomic theory, kinetic-molecular theory, theory of evolution by natural selection

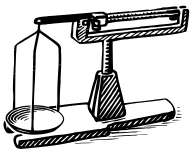
The Scientific Method

Video 112 (3:23)

Credited to Galileo Galilei (1564 – 1642) and Sir Francis Bacon (1561 – 1626).

Galileo

Activities of the Scientific Method



Observe events.

-- Quantitative data are most useful.

Propose a hypothesis:

Carry out controlled experiments:

Draw a valid conclusion.

Other Important Terms

We cannot study everything at once.

system:

surroundings:

Models simplify phenomena.

Measurements in Experiments

Measurements have dimensions and require units.

Video 115 (2:14)

give the quantity give the scale

LENGTH……..
MASS……
TIME ……
ELECTRIC CURRENT…..

SI base units

derived units: these result when base units are combined by X or ÷

e.g., area → volume →

density → momentum →

Accuracy and Precision

Video 118 (4:52)

All numerical data are the result of uncertain measurements.

precision: a measure of the degree of fineness of a measurement;

it depends on the extent to which the instrument is calibrated

e.g.,

When repeated, precise measurements yield similar answers each time.

e.g., precise…

imprecise…

accuracy:

Three types of error affect accuracy.

human error:

-- minimize with repeated measurements

method error:

e.g., parallax in measuring with a meter stick

instrument error:

e.g., bathroom scale that reads 5 lbs. too heavy

Video 121 (5:34)

Significant Figures: ***Is a digit significant?***

All non-zeroes are significant. Zeroes might or might not be.

Use the box-and-dot method to determine the sig figs in a given quantity.

1. Identify the leftmost AND rightmost non-zeroes.
2. Draw a box around these AND everything in-between.
3. All digits IN the box are significant.
4. Zeroes on the box's LEFT are NOT significant.
5. If there is a decimal point ANYWHERE, the zeroes on the box's RIGHT ARE significant. Otherwise, no.

EX.

124.00	0.0944
0.0032	2000
1300.40	800.
0.00304	0.0250

In scientific notation, the exponent has no effect on the number of sig. figs.

EX.

1.40×10^{9}	7.120×10^{5}
5.06×10^{-3}	720×10^{3}

Video 124 (5:10)

Rules: Significant Figures and Mathematical Operations

1. When multiplying or dividing, the answer must have the same number of sig. figs. as does the quantity with the fewest sig. figs.

EX.

$1.52\ \text{C} \div 3.431\ \text{s} =$

$0.0251\ \text{N} \times 4.62\ \text{m} \div 3.7\ \text{s} =$

2. When adding or subtracting, the answer must be rounded to the place value of the least precise quantity.

EX.

$2.53\ \text{s} + 117.4\ \text{s} =$

$2.11\ \text{m} + 104.056\ \text{m} + 0.1205\ \text{m} =$

3. Conversion factors are exact numbers, so they do NOT affect the # of sig. figs. Your answer should have the same # of sig. figs. as does the quantity you start with.

Video 127 (4:02)

EX. Round to the correct number of significant figures.

Calculator says…	2 sig. figs.	3 sig. figs.	5 sig. figs.
75.6			
0.528396			
387600			
4200			
8.4845E−4			

Math Review

Video 130 (2:46)

SI Prefixes to Memorize

Prefix	Symbol	Meaning
giga-	G	10^{9}
mega-	M	10^{6}
kilo-	k	10^{3}
deci-	d	10^{-1}
centi-	c	10^{-2}
milli-	m	10^{-3}
micro-	μ	10^{-6}
nano-	n	10^{-9}
pico-	p	10^{-12}

Video 133 (5:59)

Conversions

EX. Convert 4.83 cm to nm.

EX. Convert 418 km/h to m/s.

Video 136 (3:56)

Solving Equations for a Variable

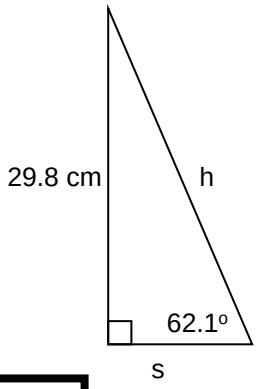
EX. Solve for g. $T = 2\pi\sqrt{\frac{L}{g}}$

EX. Solve for θ_c. $n_i \sin\theta_c = n_r$

Video 139 (3:45)

Trigonometric Functions

EX. Find h and s.



Video 142 (3:06)

Introductory Physics Vocabulary

Video 145 (3:03)

displacement, Δd: the straight-line difference between two points

-- typical SI unit:

-- Key diff. btwn distance and displacement:

**

velocity, v: displacement per time

-- equation:

-- typical SI unit:

-- Key diff. btwn speed and velocity:

**

acceleration, a: the RATE at which something speeds up, slows down, or changes direction

Video 144 (4:11)

-- equation:

-- typical SI unit:

mass, m: a measure of the amount of "stuff" an object contains

-- ** SI base unit:

weight, F_w: a measure of the pull of gravity on an object's "stuff"

-- equation:

-- typical SI unit:

force, F: any type of push or pull

-- e.g.,

-- typical SI unit: