PHYSICS 11
Introductory Notes

Ms. Johnston
Room 106N
2016/17

Name: _____
Block: ___

Course Outline: Physics 11

Ms. Johnston (Rm. 106N)

Students will demonstrate an understanding and appreciation of the role of physics in society and develop knowledge, skills and methods employed by physicists. Emphasis will be placed on the applications of physics to everyday living and the skills needed in the workplace. Students will be engaged in the investigation of scientific questions and the development of plausible solutions.

Course Content

Section 1 - Introduction to Physics
- Measurements of Science
- Degree of Uncertainty
- Displaying Data
- Manipulating Equations

Section 2 - Kinematics and Dynamics
- Describing Motion: Velocity
- Acceleration
- Forces
- Vectors
- Motion in Two Directions
- Universal Gravitation
- Momentum and Its Conservation

Section 3 - Mechanical and Heat Energy
- Work, Energy and Power
- Energy
- Thermal Energy

Section 4 - Wave Motion and Geometric Optics
- Waves and Energy Transfer
- Light
- Reflection and Refraction
- Mirrors and Lenses
- Diffraction and Interference of Light

Section 5/6 - Nuclear Physics/Special Relativity

Supplies

- 3 ring binder
- graph paper (4mm)
- ruler
- pencil and pen
- calculator
- protractor

Grading and Evaluation

A	86 -100	C	60 - 66
B	73 - 85	C-	50 - 59 (Pass)
C+	67 – 72	F	40 - 49 (Fail)

First Term Mark

a) Tests (70%)
Includes quizzes and chapter/section exams. Students are responsible for completing exams missed. Expect to write exams after school or at lunch upon the day of your return.

b) Labs and Assignments (30%)
Formal labs and informal labs will be collected and graded. Homework assignments will also be collected occasionally. Any labs or assignments missed due to legitimate absences are the responsibility of the student and should be completed and handed in upon your return. Assignments or labs not handed in will result in zero.

Final Grade

a) Final Exam (20% of the final grade)
All students are required to write the final exam in Physics. The final will be comprehensive and worth 25 % of the final grade.

b) End of term mark (80%)
The end of term mark of tests and labs will consist of 75% of the final grade.
Tests (56% of the overall marks)
Labs and Assignments (24% of the overall marks)

Office Hours

Students requesting additional assistance or time to make up labs or tests may see me at lunch of after school, by appointment.

Website Information

Ms. Johnston maintains a website containing course outlines, assigned homework, notes, and links to other useful websites. If you are absent from school or unsure of the required work for the next day, please visit the website so that you can start catching up. The website address is: http://johnstonsd36.weebly.com.

Chapter 1: Introduction to Physics

What is Physics?

- Branch of science that studies the _____ world (from _____ to the _____);
- Study of the nature of _____ and _____and how they are related;
- Ability to understand or predict the _____ of activities occurring around you;
- _____ is the "language" of physics.

How do physicists study problems?

- Ask _____, _____, _____;
- Use mathematics to develop _____to explain experimental data;
- Apply the _____ _____ – all scientists study problems in an organized manner, using many techniques (Galileo Galilei).

Why learn Physics?

- _____ preparation;
- Improve _____ _____ skills;
- Better able to make informed _____ about questions related to science and technology.

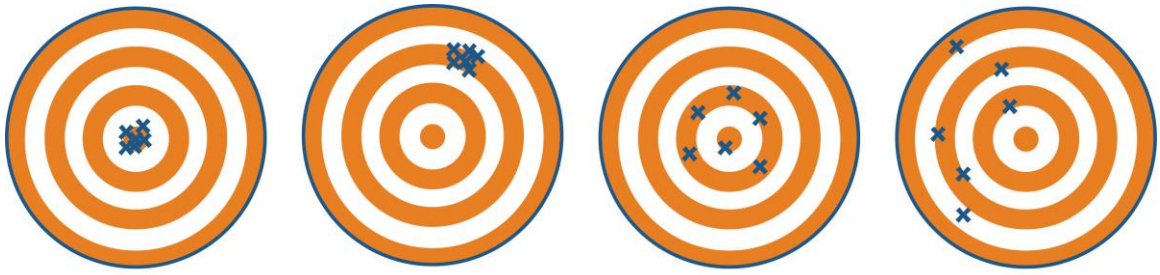
Accuracy and Precision

- _____ numbers arise from counting.
- _____ quantities are approximate.
- _____ of measurements depends on:

    a) _____ of the measurer;
    b) size of the _____ on the measuring device;
    c) _____.

- _____ refers to the degree of _____ of a measurement.

- _____ is an indication of how close a _____ value comes to the _____ value.



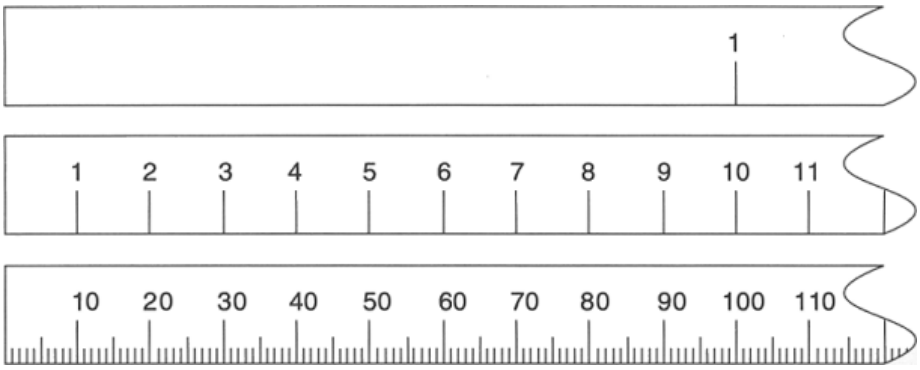
High Accuracy
High Precision

Low Accuracy
High Precision

High Accuracy
Low Precision

Low Accuracy
Low Precision

Because the precision of all measuring devices is limited, the number of digits that are valid for any measurement is also limited. Valid digits are called _____.



Significant Figures

- Digits that are _____ plus a digit that estimates the _____ of the smallest unit of the measuring scale.

- Written measured quantities express:

  a) _____;
  b) Degree of _____.

Rules for Significant Figures:

1) _____ digits are _____ significant.

e.g., 26.837 m (5 sig. Figs.)

2) All _____ zeros _____ the decimal are significant.

e.g., 56.00 mm (4 sig. figs.)

3) Zeros _____ other significant digits are always significant.

e.g., 1 000 001 m (7 sig. figs.)
107.00 s (5 sig. figs.)

4) Zeros used solely for _____ the _____ are not significant.

e.g., 186 000 m (3 sig. figs.)
0.0030 m (2 sig. figs.)

To avoid confusion, express in _____ _____:

1.86×10^5 m (3 sig. figs.)
1.860×10^5 m (4 sig. figs.)
3.0×10^{-3} m (2 sig. figs.)

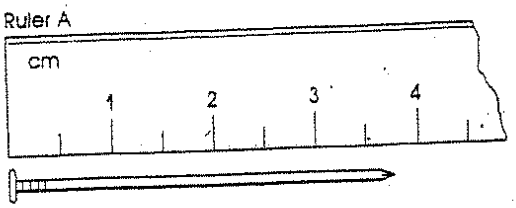
Practice:

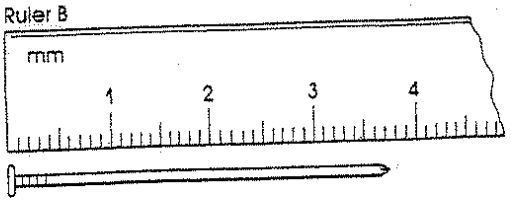
1) 2804 m
2) 284 m
3) 0.0029 m
4) 0.003068 m
5) 4.60×10^5 m
6) 783 100 kg

Accuracy and Precision

Accuracy is an indication of how close a measured value comes to the true value. Precision refers to the amount of uncertainty in the measurement. A mass reading such as 3.52 g, that has three significant digits, for example, is more precise than a reading such as 3.5 g, that has only two significant digits.

Two identical nails are placed alongside the scale of two different centimeter rulers, as illustrated below.





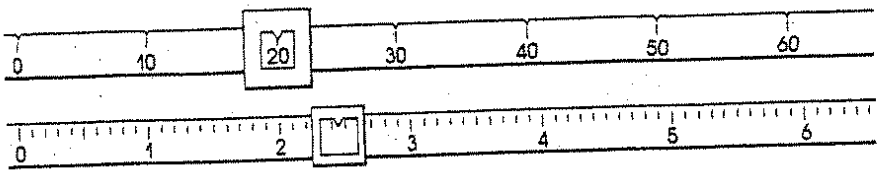
1. Complete the following chart.

	RULER A	RULER B
Smallest division of ruler		
Length of nail as measurable on ruler		
Number of significant digits		
Uncertainty (± cm)		

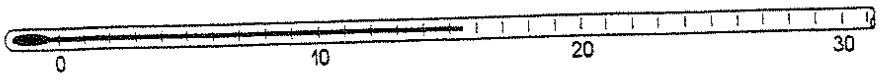
2. Which ruler allows for the more precise measurement? Why?

3. A micrometer determines that the actual length of the nail is 3.8001 cm. Which of the above measurements is more accurate? Why?

4. Read the mass shown on the balance diagram below. Record to the nearest 0.01 g. _____



5. Read the temperature shown on the diagram of a metric thermometer. Record to the nearest 0.5 °C:



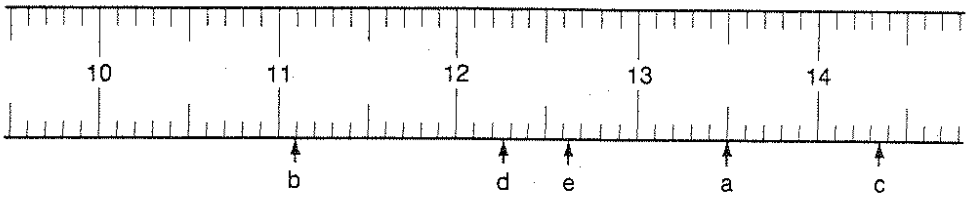
2 Physics Skill

NAME _____

For the instruments shown below, record the correct reading.

1.

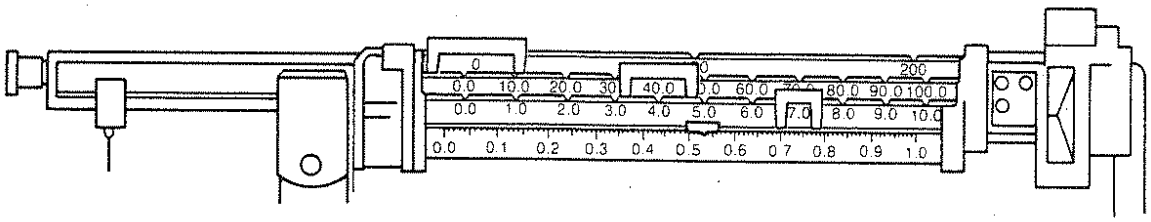
Metric Ruler



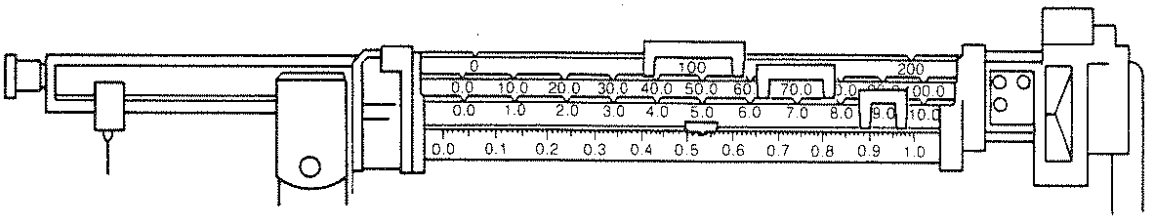
a. _____ b. _____ c. _____ d. _____ e. _____

2.

Balance

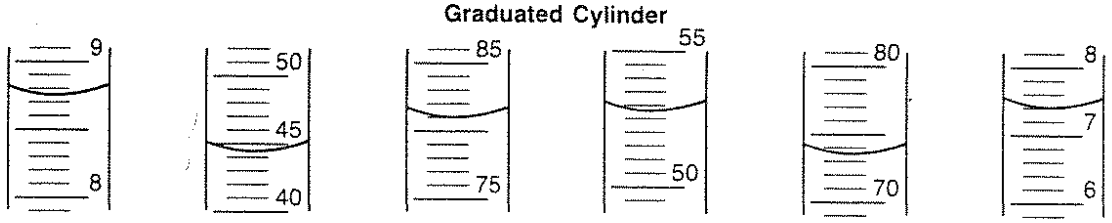


a. _____



3.

Graduated Cylinder



a. _____ b. _____ c. _____ d. _____ e. _____ f. _____

Operations with Significant Figures

The result of any mathematical operation with measurements can never be more _____ than the _____ precise measurement.

Addition and Subtraction

- Round off the calculation to correspond with the _____ **precise** measurement.
- Significant figures after the decimal point should _____ be **more** than the least precise measurement.

i.e., 24.686 m
2.343 m
+3.21 m
m

= **m**

i.e., 5.65×10^2 m – 1.56 m
= 565 m – 1.56 m
= m

= **m**

Multiplication and Division

- Round off calculation to have the _____ **number** of significant figures as the **factor** with the _____ significant figures.

i.e., 3.22 cm
x 2.1 cm
cm^2

= **cm^2**

i.e., 36.5 m
3.414 s

= m/s

= **m/s**

Practice:

1. Add	(a) 6.201 cm, 7.4 cm, 0.68 cm, and 12.0 cm	(b) 12.6 m, 1.7×10^2 m
2. Subtract	(a) 8.264 *g* from 10.8 *g*	(b) 0.4168 m from 475 m
3. Multiply	(a) 131 cm x 2.3 cm	(b) 3.2145 km x 4.23 km
4. Divide	(a) 20.2 cm by 7.41 s	(b) 3.1416 cm by 12.4 s

Additional Practice

1. Add or Subtract:

a) 94.2953 + 53.641 + 89.8 =

b) 4.37 + 12.8 =

c) 6.18 + 54.762 =

d) 28.3 – 4.3 =

e) 65.5 – 41.641 =

f) 7.92 + 3.465 + 25.22 =

g) 58.831 – 6.6467 =

h) 3.4 + 5.49 + 63.293 =

i) 7.283 + 35.328 + 21.57 =

j) 96.83 – 78.1 =

k) 5.8 + 14.978 =

l) 7.3413 – 2.341 =

2. Multiply or Divide:

a) 4 x 752 =

b) 0.032 x 14.90 =

c) 48.74 x 0.0090 x 3100 =

d) 0.62 x 8.3 =

e) 0.0036 x 917 =

f) 0.05 x 53.6 x 3000 =

g) 107 ÷ 96.66 =

h) 68.6 x 0.34 =

i) 9090 ÷ 66.88 =

j) 50 ÷ 8.697 =

k) 5800 ÷ 21.6 =

l) 14 x 0.004 =

Scientific Notation

- Used for **very** _____ or **very** _____ quantities
- The numerical part of a measurement is expressed as a number between 1 and 10 and multiplied by a whole number power of 10.

$$M \times 10^{n}$$

Where: $1 < M < 10$

n = integer

- Move decimal until 1 non-zero number remains on the left.

Examples: 5800 m = _____ m

0.000508 m = _____ m

Operations in Scientific Notation

Addition/Subtraction with Like Exponents

a) $4 \times 10^{8}\ m + 3 \times 10^{8}\ m = 7 \times 10^{8}\ m$

b) $6.2 \times 10^{-3}\ m$

-- $2.8 \times 10^{-3}\ m$

Addition/Subtraction with Unlike Exponents

- convert measurements to a common exponent, then add or subtract.

a) $4.0 \times 10^{6}\ m + 3.0 \times 10^{5}\ m$

$= 4.0 \times 10^{6}\ m + 0.3 \times 10^{6}\ m$

= _____

b) $4.0 \times 10^{-6}\ kg - 3.0 \times 10^{-7}\ kg$

$= 4.0 \times 10^{-6}\ kg - 0.3 \times 10^{-6}\ kg$

= _____

- all measurements need to be in the same units.

Multiplication Using Scientific Notation

- _____ the values and ____ the exponents;
- units are _____.

Example:

$(3 \times 10^{6}\ m)\ (2 \times 10^{3}\ m)$
$= 6 \times 10^{((6+3)}\ m^{2}$
= _____

Division using Scientific Notation

- _____ the values and _____ the exponent of the divisor from the exponent of the dividend.
- Units are _____.

Example:

$\frac{8 \times 10^{6}\ m}{2 \times 10^{3}\ s}$ = _____

$\frac{8 \times 10^{6}\ kg}{2 \times 10^{-2}\ m^{3}}$ = _____

Practice:

1. a) 2.0×10^{-6}m + 3.0×10^{-7}m **b) 2.0×10^{6}m + 3.0×10^{7}**

2. a) 3.04×10^{2}g – 4×10^{0}g **b) 3×10^{-2} g – 2×10^{-3}g**

3. a) $(2\times10^{4}m)(4\times10^{8}m)$ ***b) $(6\times10^{-4}m)(2\times10^{-8}m)$***

4. a) $\frac{6\times10^{8}\ kg}{2\times10^{4}\ m^{3}}$ ***b) $\frac{6\times10^{-5}\ m}{3\times10^{3}\ s}$***

5. a) $\frac{(3\times10^{4}\ kg)(4\times10^{4}m)}{6\times10^{4}\ s}$ ***b) $\frac{(2.5\times10^{6}\ kg)(6\times10^{4}m)}{5\times10^{-2}\ s^{2}}$***

Metric System

- _____ _____ d'Units (SI)
- Developed in _____ in 1795
- Convenient, based on powers of ___
- Fundamental/base units used worldwide:

Length	-	_____ (m)
Mass	-	_____ (kg)
Time	-	_____ (s)

Prefixes

- Used to change SI unites by powers of ten.

Prefix	Symbol	Fractions
pico	p	10^{-12} or 1/1 000 000 000 000
nano	n	10^{-9} or 1/1 000 000 000
micro	μ	10^{-6} or 1/1 000 000
milli	m	10^{-3} or 1/1 000
centi	c	10^{-2} or 1/100
deci	d	10^{-1} or 1/10
		Multiples
decka	da	10^{1} or 10
hector	h	10^{2} or 100
kilo	k	10^{3} or 1 000
mega	M	10^{6} or 1 000 000
giga	G	10^{9} or 1 000 000 000
tera	T	10^{12} or 1 000 000 000 000

Multiples Units

- Larger than the base unit (i.e., km, Mg)

How do we convert 452 g to kg?

How do we convert 5.3 kg into g?

Fractional Units

- Smaller than the base unit (i.e., cm, mL)

How do we convert 500 nm to m?

How do we convert 0.005 m into nm?

Practice:

Convert each of the following length measurements to its equivalent in meters.

1. 3.0 cm
2. 83.2 pm
3. 5.2 km
4. 0.426 Mm
4. 24.3 mm
6. 5000 nm

Convert each of the following mass measurements to its equivalent in kilograms.

1. 293 *g*
2. 207 *μg*
3. 82.3 *Mg*
4. 426 *mg*
5. 2.4 *ng*
6. 54.4 *dg*

Derived Units

- A derived unit is composed of more than one unit or units with exponents.
- Conversions require cancellations in two directions

Convert 90 km/h into m/s:

Convert 0.25 m^3 to cm^3:

Practice:

1. Convert 25 m/s to km/h:
2. Convert 85 km/h to m/s:
3. Convert 15 000 mm^2 to m^2.
4. Convert 5.0 m^3 into cm^3.
5. Convert 25 km/min to m/s
6. Convert 1.352 km/h to mm/s

CHALLENGE: (note: 1 mile = 1.6km and 1 in = 2.5cm)

7. Convert 22 miles to km
8. Convert 2ft 9in to cm

Graphing

Independent variable

- The one whose values the experimenter _____ and _____ (_____ variable);
- Plotted on the _____ axis.
  i.e., the experimenter chooses the time at which to record the distance a toy car has travelled.

Dependent variable

- _____variable;
- Changes as a result of a _____ in the other variable;
- Plotted on the _____ axis.
  i.e., The distance a toy car travels _____ as time increases.

Plotting Graphs

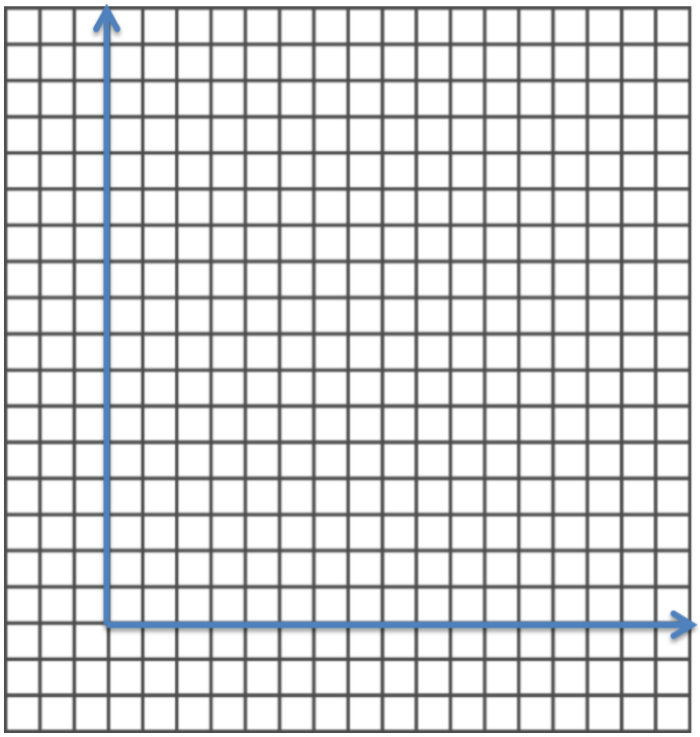
1. _____ variable is placed on the horizontal axis and the _____ variable is placed on the vertical axis.

2. Determine the _____ of data and spread the _____ as widely as possible. Number and label each _____ and put a _____ on top of the page (dependent-independent).

3. Plot each data point and _____ in pencil. Draw a small _____ around each dot, and then draw the best _____ line or _____ _____ line that passes as many _____ as possible.

Example: The distance a car travels over time is recorded in the table below. Plot the data on the graph.

Time (h)	Distance (km)
0	20
1	40
2	60
3	80
4	100
5	120



Linear, Quadratic, and Inverse Relationships

Direct (Linear)

$y = mx + b$

b = y intercept

m = constant (_____)

y = _____

x = _____

Exponential (parabolic)

$y = kx^z$

k = constant

y varies directly with the _____ of z

(as x increases, y _____ more quickly)

Inverse (hyperbolic)

$xy = k$ or $y = \frac{k}{x}$

As x increases, y decreases

_____ - finding values between measured points.

_____ - finding points beyond measured points.

- if graph is extended beyond plotted points, use a dotted line.

Manipulating Equations

$$R = \frac{V}{I}$$

Therefore, $I =$

$V =$

Solve for X:

$$\frac{Ay}{X} = \frac{cb}{S}$$

$Ay = \frac{cbX}{S}$ 1) Multiply both sides by X.

$\frac{Xcb}{S} = Ay$ 2) Rearrange X on left side

$\frac{X}{S} = \frac{Ay}{cb}$ 3) Divide both sides by cb.

$X = \frac{AyS}{cb}$ 4) Multiply by S.

Practice:

1. $y = mx + b$

a) Solve for x.

b) Solve for b.

2. Solve for v.

a) $d = vt$

b) $t = \frac{d}{v}$

c) $a = \frac{v^2}{2d}$

d) $\frac{v}{a} = \frac{b}{c}$

3. Solve for E.

a) $f = \frac{E}{s}$

b) $m = \frac{2E}{v^2}$

c) $\frac{E}{c^2} = m$

4. Solve for a.

a) $v = v_o + at$

b) $v^2 = v_o^2 + ay$

c) $v = \sqrt{2a}$