Syllabus

- **Official Course Website**: http://www.pa.msu.edu/courses/phy231
- **Lecture**: BPS1410, Sec. 1, 10:20 – 11:40; Sec. 2, 12:40 – 2:00; **Attend ONLY your section.** You will have an assigned seat for every lecture or exam. It will be sent to you by email. Have access (e.g., on your phone) to your seat number. **You Must Sit In Your Assigned Seat.**
- **Instructor**: C. Bromberg, Rm: BPS3225, Email: bromberg@pa.msu.edu, 517-884-5580
- **Office Hours**: Wednesday 11:00 – 1:00, BPS 3225, or by appointment via email.
- **Teaching Assistants**: Strosacker Physics Learning Center (BPS 1248) will have several TAs available during the hrs. 9:00 am - 9:00 pm Monday & Tuesday.
- **Textbook (R&W)**: Rex & Wolfson, College Physics, ISBN 978-0-321-61116-1. **You are strongly advised to Purchase this edition of the book.**
- **Course description and Prerequisites**: see website
- **Readings**: R&W readings, Examples, and "Got It?" components of the book are listed in the *Course Schedule* (see next page) for each lecture. Pay close attention to the worked out examples, and the "Got It?" questions; answers are at the back of each chapter.
- **I-clickers**: You must own and bring **(only your own)** "i-clicker" to **(only your)** lecture section, and sit only in your assigned seat. There will typically be a few I-clicker quiz questions during each class. The quiz questions will be based on the Examples and "Got It?" questions listed on the *Course Schedule* for that lecture.
- **HW**: The LON/CAPA (L/C) online system is used for homework. Please visit www.longcapa.msu.edu and login using your MSU Net ID and password. Select the "PHY 231, Spring 2013" class. The Homework Set # on the *Course Schedule* is due at 11:59 pm on the Tuesday evening listed. Keep a notebook and bring your attempts at solutions to any trip to the Learning Center.

- **Exams**: There will be **three midterm exams** during regular class hours on the dates shown on the *Course Schedule*. The exams will be closed book, but you may use ONE (double-sided) 8-1/2"x11" sheet of handwritten (not a copy) notes and equations during each exam. Exams are based on material from the textbook, a lecture, homework or quiz and will consist of conceptual and numerical problems. There will be a common **2-hr Final Exam on Wednesday, May 1, 8:00pm – 10:00pm**, Rm. to be decided. You will need a calculator, a #2 pencil and your student ID when taking an exam. **NO cell-phone, PDA, or computer can be used during an exam**. Alternate Final Exam will be available ONLY for students satisfying the requirements as stated by the Registrar.
- **Academic Dishonesty**: University rules and procedures regarding academic dishonesty will be strictly applied without exceptions, for i-clicker Questions, HW, and Exams.
- **Grading Criteria**: Grades are based on in-lecture i-clicker Questions (10%), L/C Homework (10%), three Midterm exams (10% each), Final Exam (50%). The 4 lowest Clicker Session grades will be dropped. See website for details. Only written Medical excuses for ONE missed Midterm Exam will be accepted. A makeup exam or a weighting by 1.5 of the sum of the other two Midterm Exams, will be at the lecturer's discretion.
- **Grades**: The mean grade in PHY231 will be about 3.0. In *each section* the approximate percentage of the enrollment obtaining each grade are; 4.0(15%), 3.5(25%), 3.0(25%), 2.5(15%), 2.0 or lower (20%).
- **Disabilities**: Students with a disability must register with the instructor in person.

Course Schedule on the back

Wk	Date	Day	Topics	R&W Reading	Examples (E)	"Got-It" (G)	L/C HW
1	1/8	T	Syllabus/Units/Sig. Fig.	Ch. 1.1-4	E 1.1-9	G 1.1-2, 4	
	1/10	Th	1D Motion Variables/Signs	Ch. 2.1-3	E 2.1-5	G 2.1-3	
2	1/15	T	1D Motion Constant Acceleration	Ch. 2.4-5	E 2.6-12	G 2.5	**Set 1**
	1/17	Th	2D Vector Algebra/Components	Ch. 3.1-3	E 3.1-4	G 3.1- 2	
3	1/22	T	2D Motion Equations/Projectiles	Ch. 3.4 (3.5 later)	E 3.5-9	G 3.4	**Set 2**
	1/24	Th	**Midterm Exam 1**	Ch. 1-3			
4	1/29	T	Force Vectors, Net Force Vector, Weight	Ch. 4.1-2	E 4.1	G 4.2	
	1/31	Th	Elastic Forces, Newton's 3 Laws	Ch. 4.2-3	E 4.2-7	G 4.3	
5	2/5	T	Friction & Drag	Ch. 4.4 (4.5 later)	E 4.8-10	G 4.4	**Set 3**
	2/7	Th	Work & Kinetic Energy	Ch. 5.1-3	E 5.1-7	G 5.1-3	
6	2/12	T	Potential Energy, Energy Conservation	Ch. 5.4-5	E 5.8-12	G 5.4-5	**Set 4**
	2/14	Th	Power, Energy and Momentum	Ch. 5.6 & Ch. 6.1	E 5.13 14, E 6.1	G 5.6	
7	2/19	T	Momentum & Newton's 2nd & 3rd Laws	Ch. 6.1-2	E 6.1-4	G 6.1	
	2/21	Th	Momentum Conservation, 1D Collisions	Ch. 6.2-3	E 6.4-10	G 6.2-3	
8	2/26	T	2D Collisions, Center of Mass	Ch. 6.4-5	E 6.11-14	G 6.4	**Set 5**
	2/28	Th	**Midterm Exam 2**	Ch. 1-6			
9	3/5		*Spring Break*				
	3/7		*Spring Break*				
10	3/12	T	Rotational Kinematics	Ch. 3.5; 8.1-3	E 3.10, E 8.1-7	G 3.5, G 8.1,3	
	3/14	Th	Newton's Laws & Rotations	Ch. 4.5; 9.1-2	E 4.11-13, E 9.1-9	G 4.5, G 9.1	
11	3/19	T	Gravitational Potential Energy	Ch. 9.3-5	E 9.10-13	G 9.4	**Set 6**
	3/21	Th	Rot. Inertia, Energy and Momentum	Ch. 8.4-5	E 8.8-11	G 8.5	
12	3/26	T	Rotational Dynamics, Equilibrium	Ch. 8.6-9	E 8.12-17		**Set 7**
	3/28	Th	Properties of Solids, Liquids & Gases	Ch. 10.1-3	E 10.1-8	G 10.2-3	
13	4/2	T	Buoyancy & Fluid Properties	Ch. 10.4-6	E 10.9-13	G 10.5	
	4/4	Th	Temperature, Heat, Kinetic Theory	Ch. 12.1-4; 13.1-2	E 12.1-13, E 13.1-4	G 12.1-4, G 13.2	
14	4/9	T	Phase Changes, Intro. Thermodynamics	Ch. 13.2-4; 14.1-2	E 13.5-14, E 14.1-6	G 13.3-4, G 14.1-2	**Set 8**
	4/11	Th	**Midterm Exam 3**	Ch. 1-13 (no 7,11)			
15	4/16	T	2nd Law of Thermodynamics, Entropy	Ch. 14.3-5	E14.7-13	G 14.3-4	**Set 9**
	4/18	Th	Oscillations, Waves & Interference	Ch. 7.1-6; 11.1-2	E 7.1-9, E 11.1-5	G 7.1-4, G 11.1-2	
16	4/23	T	Sound, Doppler Effect	Ch. 11.3-5	E 11.6-13	G 11.3-4	**Sets 10&11**
	4/25	Th	Review				
17	5/1	W	**Final Exam 8:00-10:00 pm, Rm TBD**	Ch. 1-14			

Clicker Question Tune-up: This is much like physics!

A man can mow his lawn in 1 hr.
His son takes 2 hrs. to mow the same lawn.
If they work together, how long will it take to mow the lawn?

a) 3.0 hrs.
b) 1.5 hrs.
c) 45 min.
d) 40 min.
e) 30 min.

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Why? Can't really guess this answer!
Need algebra – and insight into *what adds together* when they work together.

(speed)

What adds together is their lawn mowing rate.

Man: rate = 1 lawn per hr. = 1 lawn/hr.
Son: rate = 1 lawn per 2 hr. = 1 lawn/2 hr. = ½ lawn/hr.

Total: rate = 1½ lawn/hr. = 3/2 lawn/hr. = 3 lawns/2 hr.

Now what? Want time/lawn! It's 2 hr./3 lawns = 2/3 hr./lawn

How long is 2/3 hr. = (2/3 hr.)(60 min./hr.) = 40 min.

$(=1)$

Chapter 1

Measurements in Physics

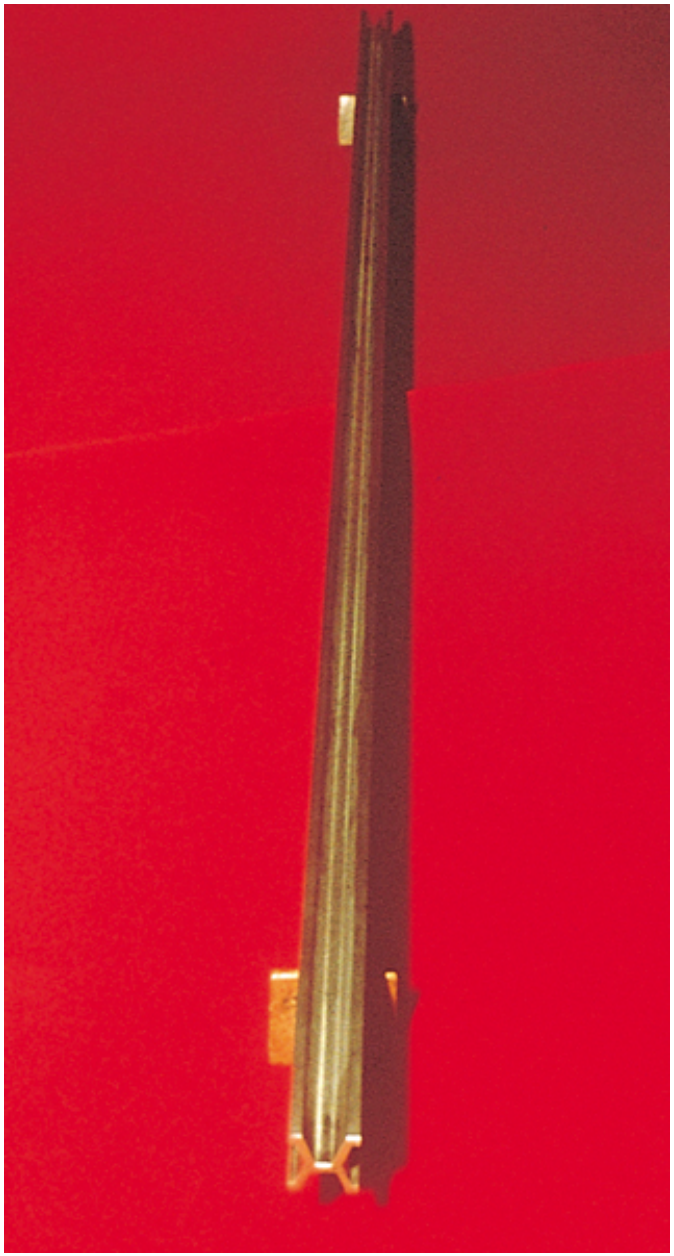
1.1 Distance, Time, and Mass Measurements

Physics experiments involve the measurement of a variety of quantities.

These measurements should be accurate and reproducible.

The first step in ensuring accuracy and reproducibility is defining the units in which the measurements are made.

1.1 Distance, Time, and Mass Measurements



1.1 Distance, Time, and Mass Measurements

SI units

meter (m): unit of length

kilogram (kg): unit of mass

second (s): unit of time

1.1 Distance, Time, and Mass Measurements

Table 1.1 Units of Measurement

	System		
	SI	CGS	BE
Length	Meter (m)	Centimeter (cm)	Foot (ft)
Mass	Kilogram (kg)	Gram (g)	Slug (sl)
Time	Second (s)	Second (s)	Second (s)

1.1 Distance, Time, and Mass Measurements

The units for length, mass, and time (as well as a few others), are regarded as *base* SI units.

These units are used in combination to define additional units for other important physical quantities such as force and energy.

1.1 Distance, Time, and Mass Measurements

Table 1.2 Standard Prefixes Used to Denote Multiples of Ten

Prefix	Symbol	Factor[a]
tera	T	10^{12}
giga[b]	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deka	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

[a]Appendix A contains a discussion of powers of ten and scientific notation.
[b]Pronounced jig′a.

THE CONVERSION OF UNITS

1 ft = 0.3048 m

1 mi = 1.609 km

1 hp = 746 W

1 liter = 10^{-3} m^3

The World's Highest Waterfall

The highest waterfall in the world is Angel Falls in Venezuela, with a total drop of 979.0 m. Express this drop in feet.

Since 3.281 feet = 1 meter, it follows that

Ratio of two identical distances: (3.281 feet)/(1 meter) = 1

$$979.0 \text{ meter} = (979.0 \text{ meter})\left(\frac{3.281 \text{ feet}}{1 \text{ meter}}\right) = 3212 \text{ feet}$$

$= 1$

The World's Highest Waterfall (Again)

The highest waterfall in the world is Angel Falls in Venezuela, with a total drop of 979.0 m. Express this drop in feet.

What if you can't remember 3.281 feet in a meter?
What do you remember? Perhaps 1 inch = 2.54 cm (yes?)
Also, 12 inches = 1 foot, and 100 cm = 1 m.

$$1\,\text{m} = (1\,\text{m})\underbrace{\left(100\ \frac{\text{cm}}{\text{m}}\right)}_{=1}\underbrace{\left(\frac{1}{2.54}\frac{\text{inch}}{\text{cm}}\right)}_{=1}\underbrace{\left(\frac{1}{12}\frac{\text{ft}}{\text{inch}}\right)}_{=1} = (1\,\text{m})\left(\frac{100}{(2.54)(12)}\frac{\text{ft}}{\text{m}}\right) = 3.281\,\text{ft}$$

Since 3.281 feet = 1 meter, it follows that

$$979.0\ \text{meters} = (979.0\ \text{meters})\left(\frac{3.281\ \text{feet}}{1\ \text{meter}}\right) = 3212\ \text{feet}$$

Reasoning Strategy: Converting Between Units

1. In all calculations, write down the units explicitly.

2. Treat all units as algebraic quantities. When identical units are divided, they are eliminated algebraically.

3. Use the conversion factors located on back of front and rear covers. Be guided by the fact that multiplying or dividing an equation by a factor of 1 does not alter the equation.

1.2 Converting Units

Example 2 Interstate Speed Limit

Express the speed limit of 65 miles/hour in terms of meters/second.

Use 5280 feet = 1 mile and 3600 seconds = 1 hour and
3.281 feet = 1 meter.

$$\text{Speed} = \left(65\ \frac{\text{miles}}{\text{hour}}\right) = \left(65\ \frac{\text{miles}}{\text{hour}}\right)\underbrace{\left(\frac{5280\ \text{feet}}{\text{mile}}\right)}_{=1}\underbrace{\left(\frac{1\ \text{hour}}{3600\ \text{s}}\right)}_{=1} = 95\frac{\text{feet}}{\text{second}}$$

$$\text{Speed} = \left(95\frac{\text{feet}}{\text{second}}\right) = \left(95\frac{\text{feet}}{\text{second}}\right)\underbrace{\left(\frac{1\ \text{meter}}{3.281\ \text{feet}}\right)}_{=1} = 29\frac{\text{meters}}{\text{second}}$$

DIMENSIONAL ANALYSIS

[L] = length [M] = mass [T] = time

Is the following equation dimensionally correct?

$$x = \tfrac{1}{2} v t^2$$

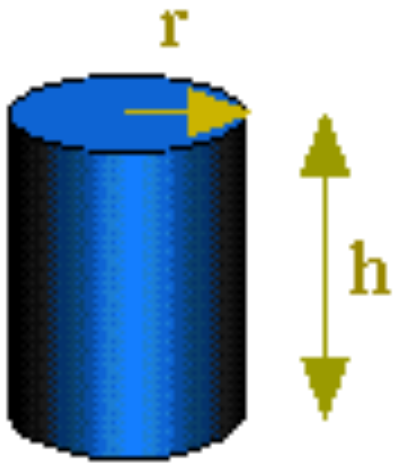
$$[\mathrm{L}] = \left[\frac{\mathrm{L}}{\mathrm{T}}\right][\mathrm{T}]^2 = [\mathrm{L}][\mathrm{T}]$$

Is the following equation dimensionally correct?

$$x = vt$$

$$[\mathrm{L}] = \left[\frac{\mathrm{L}}{\mathrm{T}}\right][\mathrm{T}] = [\mathrm{L}]$$

1.4 Measurement, Uncertainty, and Significant Figures



Measure the radius and height of this cylinder.

Use a "1 meter ruler", smallest division is 1 mm.
(Need to make sure ruler is "accurate")
Measure radius – but it is hard to find the center.
Due to sharp edges, meaurement of diameter is more "precise".
Measure diameter and divide by 2.

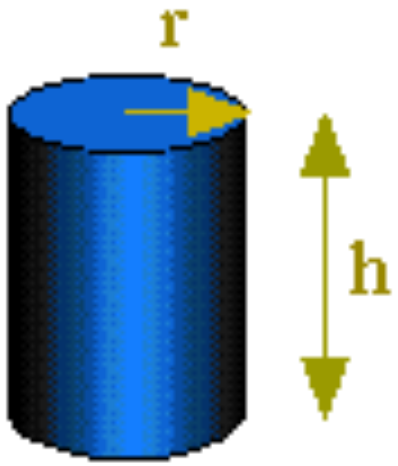
Measurements:	$d = 27.2 \pm 0.2$ cm	$h = 40.9 \pm 0.1$ cm
Calculation:	$r = 13.6 \pm 0.1$ cm	

Each dimension of the cylinder has 3 "significant figures"

Dimensions:	$r = 13.6$ cm	$h = 40.9$ cm

Any function of these dimensions also has 3 significant digits, no more – no less! Don't round off intermediate calculations.

1.4 Measurement, Uncertainty, and Significant Figures



What is the volume of the cylinder in m^3?

Dimensions: $r = 13.6\ \text{cm} \quad h = 40.9\ \text{cm}$

Volume = [Area of circle](Height)

Using a calculator gives:

$$V = \left[\pi r^2\right](h) = \left[(3.14159...)(13.6\,\text{cm})^2\right](40.9\,\text{cm}) = 23{,}765.72...\ \text{cm}^3$$

>>3 significant figures??

Volume is NOT known more "precisely" than input dimensions.

$$V = 2.38\times10^4\,\text{cm}^3\ \ (23{,}800\ \text{cm}^3)$$

Not done yet! Need answer in m^3!

$$V = (2.38\times10^4\,\text{cm}^3)(1\text{m}/100\,\text{cm})^3$$
$$= 2.38\times10^{-2}\,\text{m}^3 \quad (\text{or} \quad 0.0238\ \text{m}^3)$$