Physics 221

2018 Spring Semester

Sections 1 – 5

Please find a seat.

Keep all walkways free for safety reasons and to comply with the fire code.

Electronic Devices

Please separate your professional from your social life

Do not use social media during class.

Physics 221

Class entry point: Canvas (online.utk.edu)
Website: http://labman.phys.utk.edu/phys221/

This course is taught in a hybrid format.
Students will only meet once per week for one hour and 15 minutes in a large lecture hall, and once per week, by section, for 2 hours and 30 minutes in a studio physics classroom.

The traditional second meeting in the large lecture hall is replaced by online activities that students schedule themselves.

Class structure

- Study the online class material and consult the textbook for additional information before Thursday. The online material substitutes for one lecture. You have to read it yourself and explore the links.
- Come to class on Thursday in room 415, Nielsen.
- Complete a pre-lab assignment before 11:59 pm on Monday.
- Go to your studio session on Tuesday or Wednesday in room 207, Nielsen.
- Complete homework assignment by 11:59 pm on Wednesday.
- Repeat!

Online Class Material

- You must study the online notes.
- The online notes include links to other web materials, such as videos, animations, and simulations. I suggest that you review this material.
- The textbook expands on the material covered in the notes and offers more worked problems and practice problems.
- Answering the OpenStax Tutor questions in the online textbook correctly can earn you extra credit points.
- The tests will only cover topics that are addressed in the notes, the class meetings, the studio sessions, and the assignments.

Textbook

OpenStax Tutor, “College Physics”

This is an online textbook with spaced practice problems and feedback.

Access to this textbook costs $10 and is paid online.

You have to enroll into OpenStax Tutor.

Go to Canvas, Modules. Textbook Information and follow the instructions.

A PDF copy of the textbook (without the feedback) can be downloaded from OpenStax.

What happens in the class meetings?

- You will review what you have learned from studying the notes and the textbook.
- You will solve problems similar to the homework problems by yourself or in consultations with your neighbors. You will check by answering clicker questions.
- You can earn in-class extra credit by answering 50% (1 point) or 80% (2 points) of the clicker questions correctly.
- Attendance is required. Attending class and answering clicker questions gives you class participation credit. You must answer at least 2 clicker questions correctly.

What happens in the studio sessions?

The Studio are not just labs, and students are required to participate in all activities and stay until the session is dismissed.

Studio sessions have two components.

- This is a class with a laboratory, so you will test some of the physics principles experimentally, and you will work with simulations to develop a better conceptual understanding. A write-up for this portion of the studio sessions is provided online.

- The studio sessions will also have a problem solving and question and answer component. Your session instructors will help you to develop math skills and problem solving skills to solve physics problems.

Attendance is required. Session instructors will inform you about grading details (log, quizzes, participation).

no work <--> no credit

You cannot hide in your group.

Assignments

- Assignments are on Canvas.
- Each week you must submit a pre-lab and a homework assignment on time.
- You can submit 3 times, the highest score counts. If you submit an incorrect answer to a problem, you may get a hint.
- Make sure you know how to solve the problems on the assignments. At least for your first submission, work alone. If you do not understand why an answer is wrong, you may then consult with other students and tutors.

Please: Permit yourself to think!
Ask yourself "What does it mean?" and "How do I know?".

Do not try to "remember" physics, try to understand the concepts.

Tests

Test 1 and Test 2 are scheduled for the first hour of studio sessions 6 and 10, respectively. Test 3 is scheduled for different sections at different times during the exam period.

Practice tests for each test will be available on Canvas.

Students must use the Lockdown Browser on a Physics Department computer.

- Each student will get an individual test, drawn from a large pool of questions. No two students will have exactly the same test.
- The pool has brand-new questions, questions from the assignments, the practice test, and from in class. Students who do work the assignments and practice test and actually participate in class will have a huge advantage.

Grades

Test 1 and 2:	75 points each
Final exam:	100 points
Studio sessions:	125 points
Assignments:	75 points
Class participation:	50 points

Extra credit points are added to your total score.

You have many different opportunities to show that you are making progress in mastering the material.

- Studying the online material and completing the homework assignments are essential components. You are encouraged to study with others, but if you do not understand your own answers, you will probably pay for it with low test scores.
- Session instructors have rules for determining your lab grade.
- Class participation and in-class extra credit encourage you to actively participate in reviews of the material.

Academic Honesty

The honor statement that every UTK student has signed prohibits academic dishonesty. Penalties range from a warning to permanent dismissal.

NO!

Summary

There are no formal lectures. If you do not work through the class material before coming to class, you will waste your time in class.

Do not think that you can remember every detail. You must acquire a conceptual understanding of the material, and the class meeting will help you with this. Then, what looks like a large amount of material will condense into a manageable amount of simple principles and their applications.

Ask questions! Think for yourself, ask the instructors, the tutors, your fellow students!

Take advantage of extra credit opportunities.

Physics 221, January 11

Preliminaries:

- Units and Conversions
- Accuracy, Precision, and Uncertainty
- The Importance of Estimates

Units

Physicist want to predict the outcome of measurements.
The result of every measurement has two parts, a number and a unit.
The number is the answer to "How many or how much?"
and the unit is the answer to "Of what?".

Units are standard quantities such as a second, a meter, a mile.
The most widely used units today are those of the international system, abbreviated SI (Système International d'Unitès).

SI base units:

meter (m) for length
second (s) for time
kilogram (kg) for mass
ampere (A) for electric current
kelvin (K) for temperature
mole (mol) for amount of substance

Anything that can be measured can be expressed in some combination of SI base units. Derived units are common combinations with special names.
Example: kg m/s^2 = N (Newton) = SI unit of force

Conversions

If you work problems in SI units, the result will automatically be in SI units.

If the input quantities are given in different units, convert to SI units!

Examples

Example 1:

The speed of a car is 35 miles/hour.
What is the speed of this car in SI units (m/s)?

Conversions: 1 mile = 1609.3 m, 1 hour = 3600 s

(35 miles/h)*(1 h/3600s)* (1609.3 m/1 mile) = 15.65 m/s

Example 2:

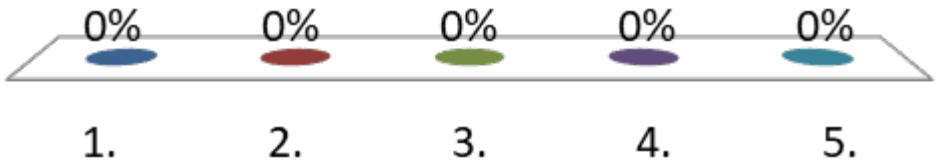
A fire burned an area of 6 square miles.
How many square meters were burned?

(6 $miles^2$)*(1609.3 m/$mile)^2$ = $1.55*10^7$ m^2

Note: If a unit appears with some power, the conversion factor must appear with the same power.

You are driving down the road with a speed of 20 m/s. What is your speed in units of miles per hour (mph)?
(1 mile = 1609.3 m)

1. 11.2 mph
2. 8.9 mph
3. 44.7 mph
4. 55.9 mph
5. 2.5 mph



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Hint:

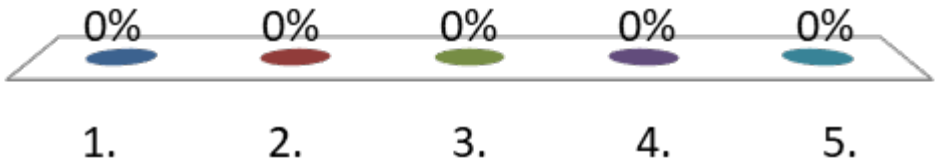
(20 m/s)*(1 mile/1609.3 m)*(3600 s/1 hour)

= ? mph

A box has a volume of 0.3 m^3. What is its volume in units of cubic feet?

1 m = 3.28 ft

1. 35.29 ft^3
2. 10.59 ft^3
3. 10.93 ft^3
4. 2.22 ft^3
5. 1.3 ft^3



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Hint:

$(0.3\ m^3)*(3.28\ ft/1\ m)^3 = ?\ ft^3$

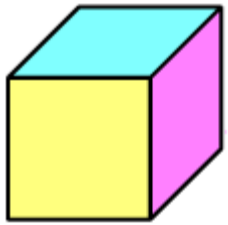
Prefixes

The 20 SI prefixes used to form decimal multiples and submultiples of SI units are given in Table below.

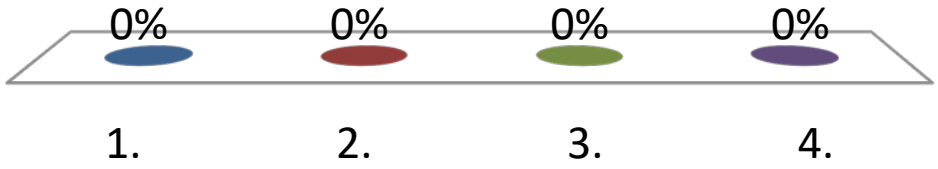
Factor	Symbol	Prefix
10^{-1}	d	deci
10^{-2}	c	centi
10^{-3}	m	milli
10^{-6}	μ	micro
10^{-9}	n	nano
10^{-12}	p	pico
10^{-15}	f	femto
10^{-18}	a	atto
10^{-21}	z	zepto
10^{-24}	y	yocto

Prefix	Symbol	Factor
deca	da	10
hecto	h	10^{2}
kilo	k	10^{3}
mega	M	10^{6}
giga	G	10^{9}
tera	T	10^{12}
peta	P	10^{15}
exa	E	10^{18}
zetta	Z	10^{21}
yotta	Y	10^{24}

In SI units 1 liter = $(0.1\ m)^3 = 10^{-3}\ m^3$. What is the length of each side of a cube containing 8 milliliter of water?



1. $2*10^{-2}$ m
2. $8*10^{-6}$ m
3. 10^{-2} m
4. $2.83*10^{-3}$ m



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Hint:

What is the volume in m^3 of 1 milliliter?

What is the volume V in m^3 of 8 milliliter?

$V = L^3$ (L = length of each side)

$L = V^{1/3}$

Accuracy, Precision, Uncertainty

Science is based on observation and experiment—that is, on measurements.

Accuracy is how close a measurement is to the correct value for that measurement.

The precision of a measurement refers to how close the agreement is between repeated measurements (which are repeated under the same conditions).

All measurements contain some amount of uncertainty. The uncertainty in a measurement, A , is often denoted as δA (“delta A ”), so the measurement result would be recorded as $A \pm \delta A$.

Percent uncertainty

% uncertainty = $(\delta A / A) \times 100\%$

Significant digits

When combining measurements with different degrees of accuracy and precision, the number of significant digits in the final answer can be no greater than the number of significant digits in the least precise measured value.

For addition and subtraction:

The answer can contain no more decimal places than the least precise measurement.

For multiplication and division:

The result should have the same number of significant figures as the quantity having the least significant figures entering into the calculation.

Estimates

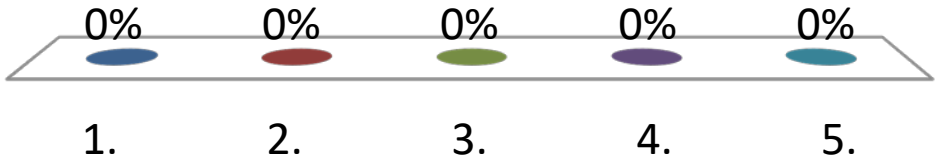
To understand the essence of a physical situations order of magnitude estimates, which round off values to the nearest power of ten, are often all that is needed.

Before doing an exact numerical calculation, always try to make order of magnitude estimates.

Check the consistency of the units for your approach to a problem!

The average spacing of atoms is about 0.2 – 0.3 nm for all elemental solids and liquids. Some large proteins consists of a strand of more than 50,000 atoms coiled up into a ball.
If the strand were pulled out into a line about how long (order of magnitude) would the strand be?

1. 10^{-4} m
2. 10^{-2} m
3. 1 m
4. 10^{-5} m
5. 10^{-6} m



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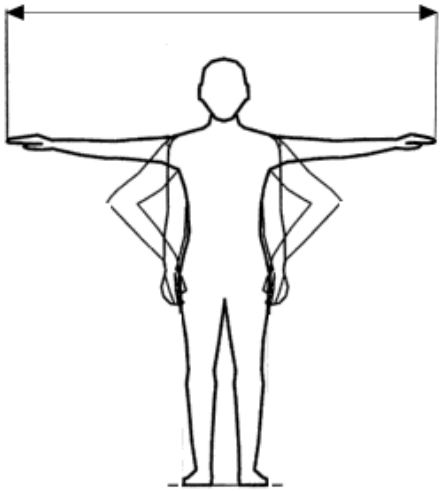
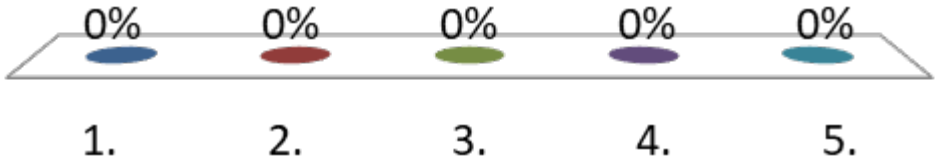
Look at a person and a meter stick. Estimate (order of magnitude) the volume of a human body, in m^3.



1. $0.01\ m^3$
2. $0.1\ m^3$
3. $1\ m^3$
4. $10\ m^3$
5. $100\ m^3$



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