

Physics 221

2015 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 Friday**.
- 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.
- Completing Concept Coach questions in the online textbook 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

"**College Physics**", a free, online textbook by OpenStax College. The link to the HTML version is on Canvas and in the syllabus. A PDF copy can be downloaded.

You get 2 points extra credit if, before a class meeting, you read through the subsections linked on the schedule and complete at least 80% of the questions and answer at least 50% of these **Concept Coach** questions correctly. If by the end of the class you have 18 or more Concept Coach extra credit points, I will add one extra point.

Class meetings

- We 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.**

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 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 12

Preliminaries:

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

Units

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'Unités).

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: $\text{kg m/s}^2 = \text{N (Newton)} = \text{SI unit of force}$

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!

Example:

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

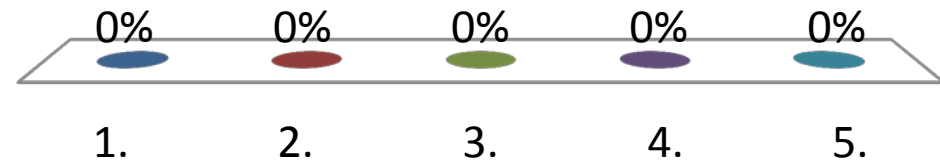
$$(35 \text{ miles/h}) * (1 \text{ h}/3600\text{s}) * (1609.3 \text{ m}/1 \text{ mile}) = 15.65 \text{ m/s}$$

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

(1 mile = 1609.3 m)



1. 1609 m²
2. 1.55*10⁷ m²
3. 1.04*10⁷ m²
4. 1.81*10⁷ m²
5. 9655 m²



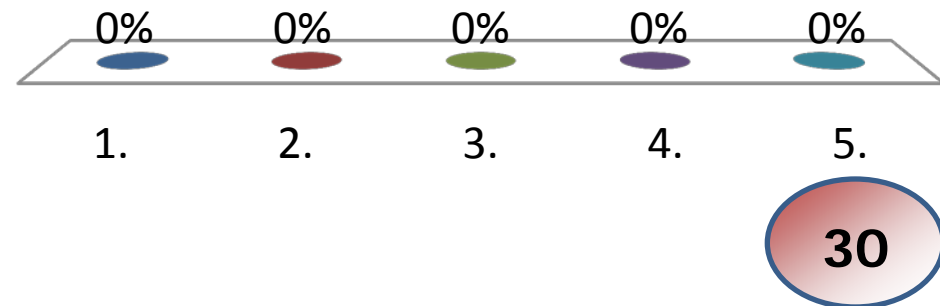
Hint:

$$6 \text{ miles}^2 * (1609.3 \text{ m/mile})^2 = ? \text{ m}^2$$

You are driving down the road with a speed of 25 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



Hint:

$$(25 \text{ m/s}) * (1 \text{ mile} / 1609.3 \text{ m}) * (3600 \text{ s} / 1 \text{ hour})$$

$$= ? \text{ mph}$$

Prefixes

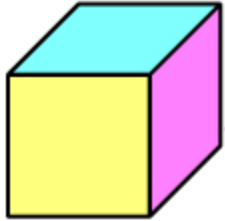
The 20 SI prefixes used to form decimal multiples and submultiples of SI units are given in Table below.

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

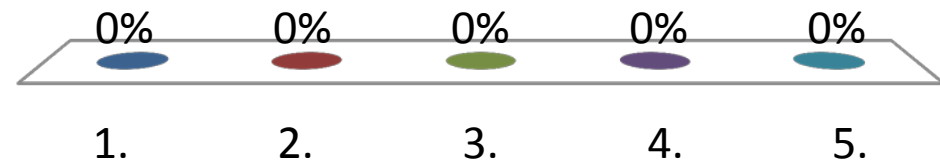
Prefix	Symbol	Factor
deca	da	10
hecto	h	10^2
kilo	k	10^3
mega	M	10^6
giga	G	10^9
tera	T	10^{12}
peta	P	10^{15}
exa	E	10^{18}
zetta	Z	10^{21}
yotta	Y	10^{24}

In a large cube, 4 feet on each side, is filled with water. How many cubic meter of water does it hold?

1 meter = 3.28 ft



1. 1.81
2. 13.1
3. 64
4. 3.53
5. 0.14



Hint:

What is the length L of each side in m?

$$V = L^3$$

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

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

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 situation's 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.

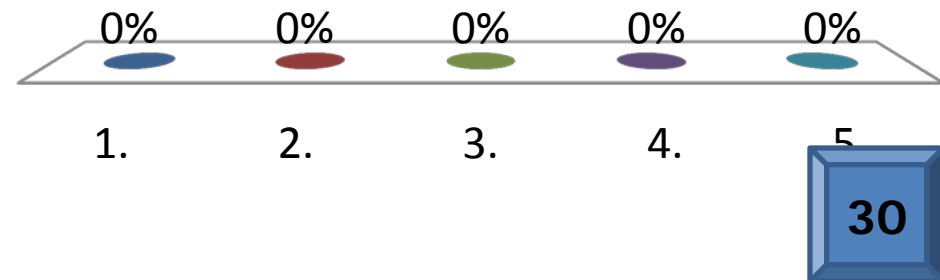
Check the consistency of the units for your approach to a problem!

The average spacing of atoms is about 0.2 – 0.3 nm for all elemental solids and liquids.

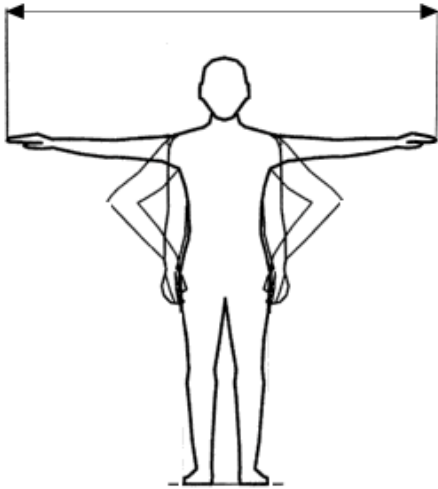
A human DNA molecule contains about 200 billion atoms.

If all the atoms formed one strand pulled out into a line about how long (order of magnitude) would the line be?

1. 5×10^6 m
2. 5×10^3 m
3. 50 m
4. 5×10^{-3} m
5. 0.5 m



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

