Physics 2010

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The trouble with the world is that the stupid are cocksure and the intelligent are full of doubt. ~ Bertrand Russell

Physics is fundamental. Physicists deal with basic concepts in science. From physics we are lead to chemistry, from chemistry to biology, from biology to psychology and from psychology to sociology. Each step is infinitely more complex than the one preceding it. Physicists can enjoy their orderly world of simple concepts but just outside that orderly world awaits a complex and chaotic reality! - Tony DiMauro

Physics is for everyone. Every student should have the opportunity to be exposed to physical principles. Students should be encouraged to find their inner scientist. Scientists observe events---phenomena. From the multitudes of events they search for patterns in nature. From these patterns they develop fundamental principles. From these fundamental principles they make accurate predictions. These accurate predictions are what help us to survive. This is our their motivation.

Taking a Physics class builds **critical thinking skills**. Students learn to solve problems based upon a proven methodology. **Critical thinking** is that mode of thinking — about any subject, content,or problem — in which the thinker improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and mindful command of their use. It entails effective communication and problem-solving abilities, as well as a commitment to overcome our native egocentrism and sociocentrism. (Criticalthinking.org)

Concepts in Physics

First Semester

Scientific Investigation and Experimentation (36 weeks)

Kinematic Motion - 7 weeks (Sept 13 / Oct 29)
Scientific Investigation and Experimentation, Scientific Theory, Principle and Law
Powers of Ten, SI System, Units, Unit Analysis
1-Dimensional Motion, Distance, Displacement, Speed, Velocity, Average Velocity, Acceleration
Free Fall, Graphical Analysis
Vectors, Trigonometry
2-Dimensional Motion (Projectile Motion), Maximum Height, Maximum Range

Special Relativity - 2 weeks (Nov 1 - 12)
The Michelson-Morley Experiment, Einstein's Postulates, Time Dilation, Length Contraction,
4-Dimensional SpaceTime, Velocity Transformations, General Relativity

Dynamics, Conservation of Energy and Momentum - 4 weeks (Nov 15 / Dec 17)
Newton's Laws, Forces, Mass, FreeBody Diagrams, Friction
Uniform Circular Motion, Gravitation, Kepler's Laws
Work and Energy, Kinetic and Potential Energy, Conservation of Energy
Linear Momentum, Elastic and Inelastic Collisions

Fluids - 2.5 weeks (Jan 10 - 25)
Density, Pressure, Pascal's Principle, Archimedes's Principle, Bernoulli's Principle, MicroFluidics

Heat and Thermodynamics - 2.5 weeks (Jan 26 / Feb 11)
Temperature, Heat, Heat Transfer, Thermodynamics, Heat Engines, Entropy

Second Semester

Waves - 2 weeks (Feb 14 / Feb 25)
Wavelength, Frequency, Speed, Transverse Waves, Longitudinal Waves, Standing Waves
Energy in Waves, Reflection, Sound Waves, Beats, Doppler Effect

Optics - 2 weeks (Feb 28 - Mar 11)
Wave Nature of Light, Reflection, Refraction, Ray Tracing, Diffraction,
Magnifying Glass, Eye, Telescopes, Microscopes

Electric and Magnetic Phenomena - 6 weeks (Mar 14 / May 6)
ElectroMagnetic Waves, Electric Charge, Insulators and Conductors, Electric Field, Capacitors
Coulomb's Law, Electric Potential, Field Lines,
Electric Circuits (DC), Electric Currents, Resistance, Voltage, Batteries, Ohm's Law
Magnetism, Magnetic Fields and Currents, Mass Spectrometer, Electric Motors
Faraday's Law, AC Circuits, Electric Generators, Transformers.

Review for CST (May 9 - 13)

Quantum Mechanics - 1.5 weeks (May 31 - Jun 10)
UltraViolet Catastrophe, Quanta, PhotoElectric Effect, Photons, Line Spectra
Quantum Implications, Uncertainty Principle , Entanglement

Nuclear Physics - 1.5 weeks (Jun 13 - 23)
Radioactivity, Alpha, Beta and Gamma Decay, Half-life

Requirements

Assessments	Total Number of Assignments	Required Number of Assignments	Points per assignment	Minimum Points each student needs
Homework Assignments	16	14	25	350
Physics Notebook	4	4	150	600
Physics Lab Reports	10	8	50	400
Physics Article Reports	8	6	25	150
Physics Projects	2	1	100	100
Quizzes	16	14	25	350
Unit Tests	3	3	150	450
Final Exam	1	1	150	150
			Total Points	**2550**

Students are allowed to miss two HW assignments, two Lab Reports, two Article Reports, two Quizzes and one Physics Project. Students are encouraged to use the two missed assignments to get other work done. If a student does do all assignments than they can be counted. There won't be any extra credit or dropped scores. The **Physics Notebook** is graded each grading period. Though, I will add back half the points missed on the Physics Notebook if you make up for lost work in the next grading period. For example; If you score 80/150 on your Physics Notebook in grading period 1, you can earn back 40 more points in the next grading period. I will also award more points than the max on every Assessment if students go above and beyond what is expected of them.

General Schedule

Grading Period 1 9/13/10 - 10/13/10	Grading Period 2 10/16/10 - 011/15/10	Grading Period 3 11/16/10 - 12/15/11	Grading Period 4 12/16/10 - 2/11/11
4 HW assignments	4 HW assignments	4 HW assignments	4 HW assignments
2 Lab Reports	3 Lab Reports	2 Lab Reports	3 Lab Reports
2 Article Reports	2 Article Reports	2 Article Reports	2 Article Reports
No Project	1 Project	1 Project	No Project
4 Quizzes	4 Quizzes	4 Quizzes	4 Quizzes
Unit Test	Unit Test	Unit Test	Final Test
Physics Notebook	Physics Notebook	Physics Notebook	Physics Notebook

Students need to turn in work according to the schedule provided. This schedule indicates the maximum number of assignments allowed in any given grading period. A student cannot make up work that has already passed. For example; If a student did not turn in any Article Reports in Grading Period 1 than the student can turn in only a maximum of 6 Article Reports instead of 8. This schedule will keep students on track and prevents jamming at the end of the semester. Remember, that you get to **to miss a total of two HW assignments, two Lab Reports, two Article Reports, two Quizzes and one Physics Project during the whole semester.**

My Teaching Philosophy

I want my students to have lots of fun, feel safe and respected by others, desire to learn and explore science, come prepared to learn, perform at their best most of the time, help others, listen to their classmates, ask great questions and have some more fun.

What does it mean that students should come prepared to learn? Students should be aware of what is happening in class everyday. You should have your books, a pen and paper. (Colored pens - red, blue, green and black). Sometimes, ask relevant and interesting questions (even if you have to make it up). Respond to other students' inquiries and help fellow students with tough concepts. Have fun, tell jokes, laugh and be respectful and considerate of other students.

What do I consider good student behavior? A student who asks sharp questions, nearly always turns in excellent work, is polite and considerate to others, and most importantly, a good student is fun, positive, creative and has a great sense of humor. Students with these attributes are wonderful in a classroom.

So, relax, sit back, laugh a little and let learning begin. . .

What do you do if you do not understand what is expected of you?

- ask clarifying questions in class,
- ask a friend in class or a group mate,
- see me after class, during nutrition or at lunch,
- write me an email, or text me.

What do I expect of you?

- come to class prepared,
- ask relevant and interesting questions,
- turn in excellent work,
- have fun, learn a lot, laugh a lot.

Physics Notebook (Binder)

1. Chapter Notes (2-4 pages)
    a. Examples
    b. Vocabulary and Scientific terms
    c. Useful Diagrams
    d. Web Supplements
    e. Indicate the Physics Standards

Use diagrams.
Don't just write a sentence!
Your diagrams can do a lot of explaining.

2. Possible Mind Map - one-page non-linear notes
3. One-Page Summary: a creative, diagrammatic summary of the chapter.
4. Individual Work - from the web.
5. Possible Article Report - use form
6. Questions and Problems - diagrams and pictures not just words!

Lab Reports

Your Lab Reports should be typed. Your diagrams should be done on the computer. You can write up equations as well. Everything done on the computer can be edited and saved for later use. You need to develop computer skills. Use Microsoft Word, Equation Editor, PowerPoint, Pages, Keynote, or any other program that will allow you to get this done. If you need help come and see me.

Lab Report Requirements

Title: Be discriptive and creative

Purpose: Nail it here. Don't write what someone else wrote. You should think of a purpose after the conclusion. This could be a hypothesis but most of you know what we are trying to discover from the book, chapter or from me.

Materials: What did you use to discover what you wanted? Remember, the materials are important. Don't be afraid to ask for something else to do what it is that is required of you.

Data Collection: This will be different for every Lab Report. You need to show the data that you collected in an appropriate format (table). You can do this on a computer much easier and quicker than writing it out. You can also do calculations on the computer that you cannot do when writing it out.

Data Analysis: This is where there should be a neat and complete diagram. Your diagram will explain what you did in this experiment. Drawing a diagram is easier and much more enlightening than a written procedure. You will also show calculations here. You need to explain what mathematical relationship you will use to discover what it is that you are looking for. Then, you will a conclusive statement. **D**iagram-**R**eason-**S**olution Method. *This section along with the Data Collection section may be reversed in order or put together.*

Conclusion: What did you learn from this experiment? What did your partner learn? Did you discover anything that you did not expect? What were some of the errors in the experiment? How could you reduce or eliminate these errors next time you performed the experiment. Be yourself, let loose.

Grading Rubric for Binder (150 points)

1. Chapter Notes (2-4 pages)
   a. Examples for the Chapter (10 points)
   b. Defined Vocabulary and Scientific terms (10 points)
   c. Useful Diagrams to explain concepts (20 points)
   d. Web Supplements (extra points)
   e. Indicate the Physics Standards (20 points)
2. Possible Mind Map - one-page non-linear notes (25 points when done)
3. One-Page Summary: a creative, diagrammatic summary of the chapter. (30 points)
4. Individual Work - from the web. (extra points)
5. Possible Article Report - use form (separate 25 points)
6. Questions and Problems - diagrams and pictures not just words! (separate 25 points)

Organization	**Neatness**	**Creativity**
20 points	20 points	20 points

Keep your Notebook up to date. Don't try to do it at the last minute. Use diagrams whenever possible. Linear notes are NOT the way our brains learn new materials. We learn in a non-linear random pattern. Mind Maps demonstrate connections and relationships between the concepts YOU learn. Get Organized. Be neat. Try to be Creative.

Grading Rubric for Lab Report (50 points)

1. Your Lab Report must be done on a computer. Get away from hand-writing anything. If you need help please see me in my help session. (up to 25 point deduction).
2. The Data Collection section should be neatly formatted, appropriate and clear. (Units and Significant figures are used correctly.) (10 points)
3. The Diagram of your experiment should be neat and complete. It should show what you did in this experiment. **Draw a Diagram**. **Visualize the problem**. Your diagram demonstrates your understanding of the experiment. Your diagram speaks for you. Imagine that someone is analyzing your diagram. What do you think they think of your representation of this problem? Be meticulous, be complete, be clear, and be artistic. If your diagram is all of this---there should be few questions asked! (20 points)
4. All important equations and calculations should be shown. (10 points)
5. There should be reasoning clearly stated in the Analysis section. (10 points)
6. Your conclusion should be complete, useful, and expressive. (10 points)

It's easy to get all the points. Take this assignment seriously. Try to learn something from it. And show others what you learned. Be neat, organized, clear and creative.

Physics is not what you may believe it is. Physics is not about equations, only. Physics is a process that every creature continually practices. Doing physics is the act of discovering patterns in nature and using these patterns in nature to extend the human experience. Becoming an expert, or a master at anything requires an adventurous, disciplined, creative, determined and resilient person. We all have many skills that may vary between, basic to expert. We are all learners as well as teachers. The best teachers are the best learners. I refuse to teach physics to my students without bringing in all the wonderful aspects of this all-inclusive discipline. This is not a class where one memorizes equations and hopefully chooses the correct multiple-choice answer in a vain hope to simply get it over with. You are always 'doing physics' every moment of your lives.

Diagram, **Reason** and **Solution** Method

1) Read the Problem. Many of these problems are quite relevant. Reread the problem. This is really important. Read it slowly. Relax. There are no tricks. The strict wording of the problem is to train you to look closely at the question.

2) Draw a **Diagram**. Visualize the problem. Your diagram demonstrates your understanding more than you think! Can artwork sum up your mood? Do artists find patterns that resonate with your personality? Your diagram speaks for you. They are not your dirty laundry. Imagine that someone is analyzing your diagram. What do you think they think of your representation of this problem? Be meticulous, be complete, be clear, and be artistic. If your diagram is all of this---there should be few questions asked!

3) What is given in the problem? Start to use the clues given to you. What else do you know that is not given?

4) What are you solving for? Keep returning to this. You will forget.

5) **Reason** out your path to a solution. Explain it to yourself or a group member. What were the main concepts and guideposts that will help you discover the solution to this problem? Internalize this process! You will use it again and again. You must articulate your learning process through dialogue, diagramming and reasoning.

6) Find and utilize appropriate equations---manipulate them. Do not use derived equations. It's like getting a birthday cake from Von's. Someone else put these standard equations together. These standard equations are maps created by people before you. Do you always follow the map? Look at the equation for what it is and---it is not. Equations have feelings, too! Give them quality time.

7) Plug, Shove and find the **Solution**. This is the easy part. The calculator does the work. Monkeys can punch in numbers!

8) Check and reflect on your answer. How did this particular solution process relate to other solutions you have already done? How can you generalize this solution process for future problems? How does the answer compare to your prediction?

There are two goals that I would like to discuss. First, working with a group of students is both expedient and rewarding. Talk to a few people and agree to meet-up to discuss the problems. From 17 years experience, I have learned that students who form groups are the most successful students. Second, **you must practice articulating with your peers and your Instructors through open dialogue, diagramming and reasoning**. You need to practice your skills with other students. My two cats are constantly practicing their skills with each other. They want to get better at attacking and killing smaller prey. So, they chase each other. Sometimes they run into walls or slip on the floor. They are embarrassed! But, they are learning and they are learning through each other.

Problem Solving is not about how quickly one finds the solution. **Problem Solving is about the learning process---the journey.** Mountain climbers know how to scale shear walls because they have developed a process. Surfers know which waves are the right waves and how to ride different waves because of a learned process. What's the goal of either the mountain climber or the surfer? Is it to get to the top of the mountain, or the wave? I don't think so. I believe that it is learning how to get to the top. Once at the top, both the climber and the surfer are looking for new tougher challenges and more exciting adventures.

All the problems in this book are basic. The math is basic. The learning process is basic. It is NOT simple, but it is basic. Don't psych yourself out. Everyone in this class is quite capable of getting to the top. After the first four chapters, the concepts and the problem-solving process will become more evident. Hang in there. Since it is the learning process I respect, I will utilize Progressive Grading. Everyone has the ability to be successful (to get an A) in my class. I look forward to your success.

Article Report Form

Name _____

Class _____ Period ____

Name of Article _____

Author(s) _____

Source _____

Article Summary (Abstract - what is the article about?)

_____

_____

_____

_____

_____

Physics Concepts (be specific)

1. _____
2. _____
3. _____
4. _____

Standards Connection to the Article Concepts

1. _____
2. _____
3. _____

What did you like about the article?

Physics Chapter ____ Problem _____ Name _____

Write the problem here.

Please be clear, concise and complete. Use the DRS method
Use scrap paper first, then use this sheet.

You should avoid writing in paragraphs. Write your reasoning next to what you are trying to explain. Diagrams should be complete, sharp and large. Solutions should start from first principles.

Diagram ____ Reasoning _____ Solution _____

Possible Class Projects

1. King of the Hill (up to 150 pts) - February 19, 2010

Build a car to travel up a ramp and fight for the top.

Requirements: The car must make it to the top of the hill by itself. It must have both a defensive and offensive mechanism. Car must be less the 12 inches long and 12 inches high. No slingshots!

Structural Integrity (Is the construction of the car sound?)	25
Design (propulsion/defensive/offensive mechanisms)	15
Did the car get to the top of the hill? (Your car must make it to the top)	20
Does the car have a Defensive Mechanism?	15
Does the car have an Offensive Mechanism?	15
Did the defensive and offensive mechanisms operate as planned?	10
Did your car win? (Extra Credit)	20

2. Science Fair Project (up to 150 pts) - March 2, 2010

Choose a topic in which you are genuinely interested. The topic may be one related to a longtime hobby or something entirely new for which you would like to have a better understanding.
Some scientific displays like collections, illustrations or models are NOT science fair projects.

3 Electric Motor - Radio - Electronic Kit (up to 100 pts) - March 12, 2010

4. Rube Goldberg (up to 150 pts) - June 7, 2009

5. Physics Demonstration Model (up to 150 pts)

Physics Notebooks (1.5 inch 3-ring binder with cover pocket)

- This notebook has to stay in excellent shape through out the semester.
- All required work must be in this binder upon grading
- Notebook may stay at home most of the time.

September 2010

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October 2010

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November 2010

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December 2010

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

January 2011

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February 2011

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

January

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

March

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

April

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Student Matrix to follow their Progress

	Homework Assignments	Quizzes	Lab Reports	Article Reports	Physics Notebook	Tests	Projects
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

- **Students are allowed to miss any two HW assignments, any two Lab Reports, any two Article Reports, any two Quizzes and one Physics Project.**

- Students are encouraged to use the two missed assignments to get other work done.

- If a student completes assignments than all assignments can be counted. There won't be any extra credit. For example; if a student does all 16 HW assignments than your grade will be based on 400 points instead of 350 points.

- Your **Physics Notebook** is graded each grading period. Though, I will add back half the points missed on the Physics Notebook if you make up for lost work in the next grading period. For example; If you score 80/150 on your Physics Notebook in grading period 1, you can earn back 40 more points in the grading period 2, and so forth.

- I will also award more points than the maximum on every assignment if students go above and beyond what is expected of them. This will be my call. I will show you how students do get more points.