This is a handbook to help you in studying Physics 1

Contents

Introduction

This document is to help you study for the physics 1 course. The syllabus section is the parts most needed by the students.

Syllabus (part)

Course Learning Outcomes

After completion of this course, students should be able to:

CLO1: Use SI units, unit conversions and significant figures.

CLO2: Add vectors graphically and analytically.

CLO3: Apply a simple mathematical model to solve one- and two-dimensional motion problems.

CLO4: Apply Newton's laws to solve simple one- and two-dimensional situations.

CLO5: Calculate work and power of simple systems and use the work energy theorem.

CLO6: Apply the principle of conservation of linear momentum to particles.

CLO7: Perform basic calculations on rotational motion in terms of angular displacement, velocity and acceleration. Kinetic energy and moment of inertia.

CLO8: Perform calculations on rotational dynamics in terms of, torque, work and power.

CLO9: (Optional) Perform calculations on Pascal's Law in fluids and apply Archimedes principle to solids in fluids.

Grading Policy

Assignments & Projects	10%
Quizzes	20%
Mid-term Exam	30%
Final Exam	40%
Total	100%

Week-by-Week Teaching Plan

Week	Topic	Content	Textbook Reference
1	Units	• SI units, Unit conversions and significant figures	Ch 1
2	vectors	• Vectors and Vector Addition. Components of Vectors	Ch1
3	Motion along a Straight Line	• Linear motion equations, constant/average speed or velocity problems, constant/average acceleration, special cases of constant/average acceleration problems, relative velocity	2.1-2.7
4 & 5	Motion in a Plane (projectile motion)	• Velocity in a plane. Acceleration in a plane. Projectile Motion. Relative velocity in a plane.	3.1-3.3 3.5
6	Newton's first law, Mass, Newton's second law & third law, Friction, Applications of Newton's laws	• Force, Newton's laws, Free-body diagrams • Force problems, problems with objects connected by strings and ropes, kinetic friction, maximum static friction, inclines or ramps, objects pushing on each other	4.1-4.6 5.1-5.5
7	Work and energy	• Work done by a constant/average force, work problems with two or more forces, work problems with unknown forces, work-energy theorem for kinetic energy • Potential energy, Conservative and non-conservative forces, work-energy theorem, work-energy problems, conservation of energy, conservation of energy problems	7.1-7.4 7.5-7.8
MIDTERM (week 8)			
8 & 9	Linear Momentum: Conservation of linear momentum	• Linear Momentum • Conservation of linear momentum • Collisions: elastic and inelastic collisions • Simple 1D and 2D situations	Ch 8
10 & 11	Rotational Motion	• Angular Displacement • Angular velocity • Angular acceleration • Radial and tangential acceleration • Linear Velocity • Kinetic energy and moment of inertia	Ch 9
12 & 13	Dynamics of rotational motion	• Tangential and radial Forces • Torques and Moment of Inertia • Angular Momentum • Relation between Momentum of a Force and Angular Momentum • Work and power in rotational motion • Equilibrium of a rigid body	Ch 10

14 & 15	Fluid mechanics (optional)	• Perform calculations on Pascal's Law in fluids and apply Archimedes principle to solids in fluids • Fundamentals of fluid mechanics: density. Static pressure. Pressure gauges. Buoyancy. Bernoulli's equation. Real fluids (viscosity and turbulence)	Ch 13
16	FINAL EXAM		

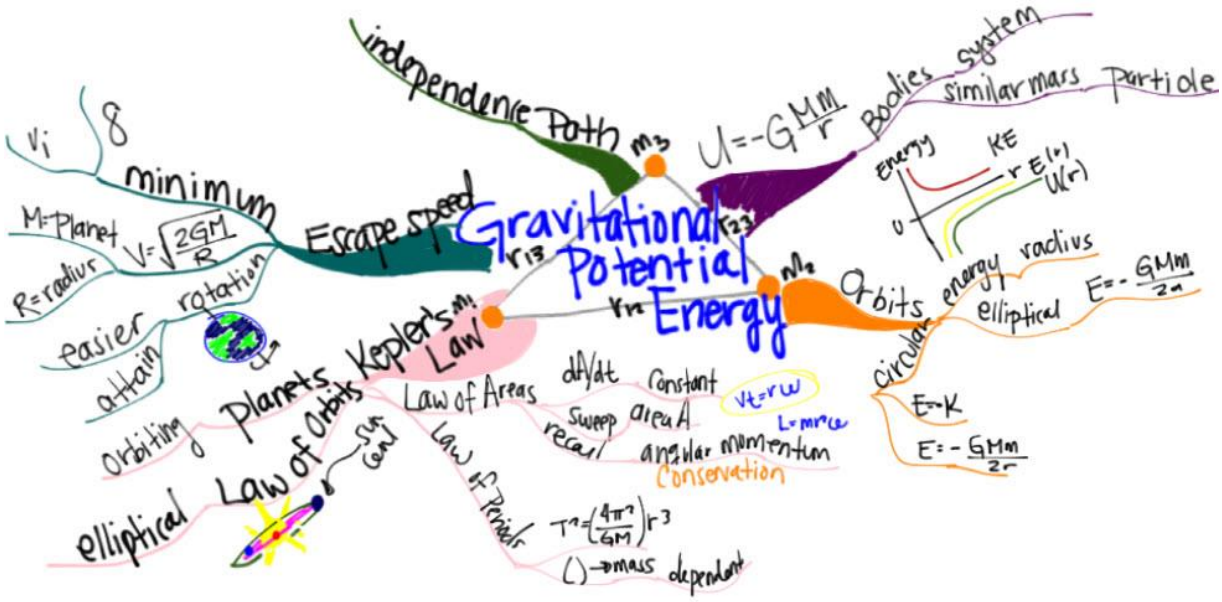
Advice in studying

Sorry. There are no shortcuts.
The advice given here you will have heard many times. I have tried to distill it to the minimum in order to help.

"The first principle is that you must not fool yourself - and you are the easiest person to fool." (Richard Feynman)
This quote should be taken to heart - not just in physics but in life as well.

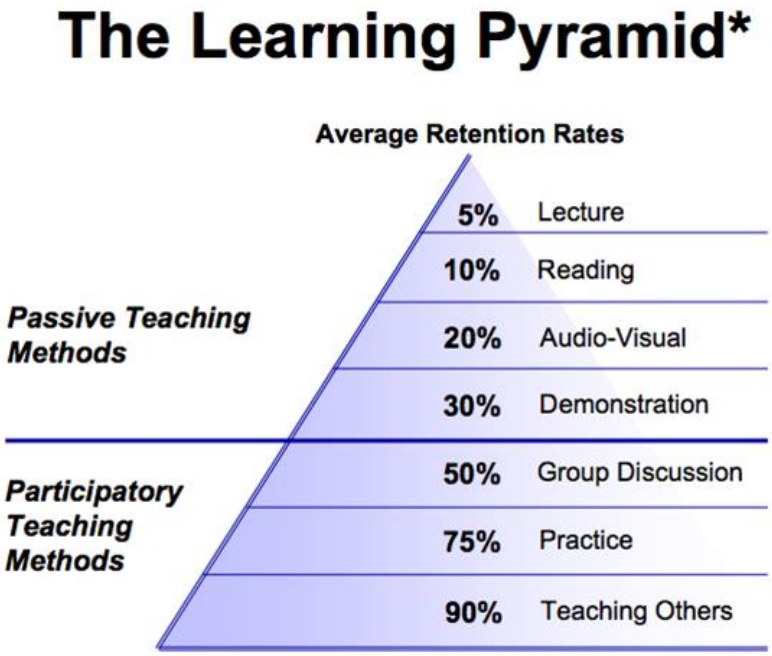
1) Make sure **you** understand the physics.
This means you want to develop some sort of feeling about physics. The best way to know if you understand or not is to try questions. Do some questions and ask yourself if you are confident in your answer. Does the result make sense? If it does make sense and you have solved it correctly and got the right answer then you can be confident that you understand this principle.
If you got it right but you don't know why then you need to do some more work on this.
If you got it wrong but you felt confident that you know the material then check your work and try to find your mistake. It may be obvious.
Be honest with yourself.

2) Make sure **you** see the connections between different concepts.
All of physics work together. There is a connection between electricity and magnetism called electromagnetism. This was not known at the beginning.
When you connect different concepts you are working in the way that your brain works. Different neurons fire and it is the connection between these that grows. Maybe between millions of neurons. The growth in these connections is learning.
We can try to do this by using mindmaps. Mindmaps connect concepts together to make it easy to see how one idea relates to another.



The above example not only links the basic concepts of gravitational potential energy but also provides a very useful summary that can remind you quickly of what you have learnt. It is important that **you** make your own mindmaps.

3) Be active in your own learning and take full **responsibility** for it. The best way to learn is by teaching others as shown in the pyramid below. Just by listening to a teacher you will only retain 5%. Practicing questions is 75%.



*Adapted from National Training Laboratories. Bethel, Maine

4) Don't blame or relay on the teacher.
Some teachers are better than others. Some of them you will understand, some you will not. This could depend on different teaching and learning styles.
If you get a teacher you don't understand so well then you may need to do more work by yourself.

5) Hints on answering questions

- Do I understand the question?
- Have I written down all the variables or sketched a diagram?
- Are they in the correct units?
- Do I know what I need to find out?
- Do I have an equation that lets me calculate the answer?
- If I don't have all the variables for that equation can I find them from other equations?

You may need to repeat this and look in other areas of physics.

- Does the answer I have make sense?

Check through the working out. Most questions have answers which are connected to reality (ie the height of the normal building is not going to be 4 cm)

Hyperphysics, Khan academy, flipping physics and PhET links

Hyperphysics is an excellent site which is very fast to navigate. It is based on a first year undergraduate physics course in an American university.

Khan Academy is a series of on line lectures based on ap-physics-1 in America.

Flipping physics is very good to summarise a topic.

PhET include a series of Simulations for motion and work, energy and power at

- https://phet.colorado.edu/en/simulations/category/physics/motion
- https://phet.colorado.edu/en/simulations/category/physics/work-energy-and-power

Arranged according to CLO

CLO1: Use SI units, unit conversions and significant figures.

CLO2: Add vectors graphically and analytically.

CLO3: Apply a simple mathematical model to solve one- and two-dimensional motion problems.

- http://hyperphysics.phy-astr.gsu.edu/hbase/units.html#unit
- http://hyperphysics.phy-astr.gsu.edu/hbase/vect.html#veccon
- http://hyperphysics.phy-astr.gsu.edu/hbase/mot.html#motcon
- https://www.khanacademy.org/science/ap-physics-1/ap-one-dimensional-motion
- https://www.khanacademy.org/science/ap-physics-1/ap-two-dimensional-motion
- http://www.flippingphysics.com/ap1-kinematics-review.html

CLO4: Apply Newton's laws to solve simple one- and two-dimensional situations.

- http://hyperphysics.phy-astr.gsu.edu/hbase/Newt.html#ntcon

- https://www.khanacademy.org/science/ap-physics-1/ap-forces-newtons-laws
- http://www.flippingphysics.com/ap1-dynamics-review.html

CLO5: Calculate work and power of simple systems and use the work energy theorem.

- http://hyperphysics.phy-astr.gsu.edu/hbase/work.html#wep
- https://www.khanacademy.org/science/ap-physics-1/ap-work-and-energy
- http://www.flippingphysics.com/ap1-work-review.html

CLO6: Apply the principle of conservation of linear momentum to particles.

- http://hyperphysics.phy-astr.gsu.edu/hbase/conser.html#conmom
- https://www.khanacademy.org/science/ap-physics-1/ap-linear-momentum
- http://www.flippingphysics.com/ap1-momentum-review.html

CLO7: Perform basic calculations on rotational motion in terms of angular displacement, velocity and acceleration. Kinetic energy and moment of inertia.

CLO8: Perform calculations on rotational dynamics in terms of, torque, work and power.

- http://hyperphysics.phy-astr.gsu.edu/hbase/circ.html#circ
- https://www.khanacademy.org/science/ap-physics-1/ap-torque-angular-momentum
- http://www.flippingphysics.com/ap1-rotational-kinematics-review.html
- http://www.flippingphysics.com/ap1-rotational-dynamics-review.html

CLO9: (Optional) Perform calculations on Pascal's Law in fluids and apply Archimedes principle to solids in fluids.

- http://hyperphysics.phy-astr.gsu.edu/hbase/fluid.html#flucon
- https://www.khanacademy.org/science/physics/fluids

Other links

- www.feynmanlectures.caltech.edu/
- http://www.sixtysymbols.com/
- http://physicsworld.com/