

Physics I: Summary

Physics I. Fall 2021

College of the Atlantic

Book C: Conservation Laws Constrain Interactions

Big Idea: There are three quantities—momentum, energy, and angular momentum—which remain constant for any isolated system.

Other topics and ideas:

1. Mathematics of vectors: components, addition, subtraction, dot product, cross product
2. Applying momentum conservation
3. Forces as rate of momentum transfer, impulse
4. Potential energy for gravitational and spring-like interactions
5. Angular speed, radians
6. Rotational kinetic energy, moment of inertia
7. Thermal energy, specific heat
8. Energy in bonds, latent heat
9. All sorts of conservation of energy applications
10. Power
11. Angular momentum and angular momentum applications

Book N: Newton's Laws are Universal

Big Idea: Newton's three laws:

1. An object at rest stays at rest, and an object in motion maintains that motion, unless acted upon by an external force.
2. $\vec{F}_{\text{net}} = m\vec{a}$.
3. When two objects interact, the force one object exerts on the other is equal and opposite to the force the other object exerts on the first object.

These laws hold anywhere in the universe. They tell us how motion and forces are related.

Other topics and ideas:

1. Describing motion: motion diagrams, position, velocity, and acceleration graphs
2. Determining forces from motion
3. Free body and net force diagrams
4. Torque
5. Statics: $\vec{F}_{\text{net}} = 0$ and $\tau_{\text{net}} = 0$

Some Math and Physics Skills

1. Unit conversions
2. Paying attention to units in equations
3. Developing a structured approach to problem solving
4. Writing out your thought process as a way to make you think differently and more deeply about what you're doing
5. Checking formulas by looking at limiting cases
6. Checking numerical answers to see if they make sense
7. Making approximations and estimates

Some Statistics

- You solved 80 problems this term:
 - 33 textbook problems
 - 42 edfinity problems
 - 5 exam problems
- There are 16 students in the class.
- The total number of problems done is thus 1,280.

What Next?

- Physics II: Focusing on special relativity and quantum mechanics. Not necessarily harder than Physics I, but more abstract. Will also read and discuss some history and philosophy of science articles. The focus for the quantum mechanics part of the course is to develop a quantitative and qualitative understanding of what makes quantum mechanics a fundamentally different sort of physical theory than classical mechanics. (Spring 2022)
- Physics and Mathematics of Sustainable Energy. Basic physics of all sorts of energy generating and using technologies. Analytic skills for evaluating different technologies, investments, etc. Lab. Less mathematical than Physics I. (Fall 2022)
- Calculus III (Winter 2022) and Calculus I and II (Fall/Winter 2022/23).
- Other post-calculus classes: Differential Equations, Linear Algebra, Thermodynamics.