This course supports the assessment for C876. The course covers 2 competencies and represents 5 competency units.

Introduction

Overview
This course provides a broad overview of the principles of mechanics, thermodynamics, wave motion, modern physics, and electricity and magnetism, light, and modern physics. Students are invited to apply these principles by solving problems and reflecting on concepts and ideas.

Getting Started
Welcome to Conceptual Physics! Whether you know it or not, you already have some knowledge of this subject; from your previous schooling, reading, watching television shows and movies, and just interacting with the world. An understanding of physics will allow you to better understand all branches of science and the unifying concepts that transcend them. Readings in VitalSource and other online resources are available to you throughout the course. Your competency for this course will be demonstrated by completing an objective assessment.

Below you will find a list of competencies for this course, and the Statement of Teaching Dispositions. To navigate this course, please click the "Launch Course" button.

Competencies
This course provides guidance to help you demonstrate the following 2 competencies:

- **Competency 204.4.1: Energy**
  The graduate has a broad understanding of energy, including mechanics, heat, and electricity and magnetism.

- **Competency 204.4.2: Nuclear Physics and Wave Motion**
  The graduate has a broad understanding of wave motion and atomic nuclear physics.

Teaching Dispositions Statement
Please review the Statement of Teaching Dispositions.

Course Instructor Assistance
While you prepare to demonstrate competency in this subject, remember that course instructors are ready to help you reach your educational goals. As subject matter experts, instructors enjoy and take pride in helping students become reflective learners, problem solvers, and critical thinkers. Course instructors are excited to hear from you and eager to work with you. Successful students report that working with a course instructor is the key to their success. Course instructors are able to share tips on approaches, tools, and skills that can help you apply the content you are studying. They also provide guidance in assessment preparation strategies, troubleshoot areas of deficiency, and guide you through the revision process if necessary. You should expect to work with course instructors for the duration of your coursework, so you are welcome to contact them as soon as you begin. Course instructors are fully committed to your success!
Preparing for Success

The information in this section is provided to detail the resources available for you to use as you complete this course.

Learning Resources

For many resources, WGU provides access through links in your courses. However, you may need to enroll manually or acquire other resources independently. Read the full instructions provided to ensure that you have access to all your resources in a timely manner.

Automatically Enrolled Resources

You can access the learning resources listed in this section by clicking on the links provided throughout the course. You may be prompted to log in to the WGU student portal to access the resources.

VitalSource E-Text

The following textbook is available to you as an e-text within this course. You will be directly linked to specific readings and activities from within the course.


*Note: This e-text is available to you as part of your program tuition and fees, but you may purchase a hard copy at your own expense through VitalSource or a retailer of your choice. If you choose to do so, please use the ISBN listed to ensure that you receive the correct edition. The following sites provide instruction on how to create a VitalSource account, use features such as downloading your e-texts for offline use, and purchase a print-on-demand option, if available.*

[Link to VitalSource Navigational Video]
[Link to Print-On-Demand Option]

Additional Preparation

Graphing Calculator

Acquire a graphing calculator and familiarize yourself with how to use it. Refer to the [WGU Calculator and Scratch Paper Guidelines] document for calculators permitted on WGU exams. If you are in a secondary mathematics program, refer to the [WGU Calculator Recommendations for Secondary Math and Science Programs] document for calculator suggestions for your degree program.

Pacing Guide

The pacing guide suggests a weekly structure to pace your completion of learning activities. It is provided as a suggestion and does not represent a mandatory schedule. Follow the pacing guide carefully to complete the course in the suggested time frame.

Week 1: Mechanics, Part I
• Science
• Linear Motion
• Newton’s Laws of Motion
• Applications of Motion

Week 2: Mechanics, Part II

• Momentum
• Energy
• Rotational Motion
• Universal Law of Gravity

Week 3: Thermodynamics

• Temperature and Heat
• Heat Transfer
• Thermodynamics
• Waves
• Doppler Effect
• Sound

Week 4: Electromagnetism

• Electricity
• Electric Current
• Magnetism
• Inverse Square Law

Week 5: Light

• Electromagnetic Waves
• Application of Light

Week 6: Modern Physics

• Radioactivity
• Nuclear Fission and Fusion
• Special Theory of Relativity

*Note: This pacing guide does not replace the course. Please continue to refer to the course for a comprehensive list of the resources and activities.*

**Mechanics, Part I**

In this section, you will learn about the laws that govern linear and rotational motion, forces, momentum, energy, and gravity.
Science
Work through the activities in this topic to gain understanding of the nature of science. You will learn about the importance of measurement, mathematics, and attitude in the study of science. You will also learn about scientific methods and the relationship between science, technology, and society.

Read

- Chapter 1 "About Science" from Conceptual Physics

Linear Motion
Work through the activities in this topic to gain an understanding of displacement, speed, velocity, and acceleration. You will learn how these ideas and concepts relate and how to solve problems using kinematic equations.

Read

- Chapter 3 "Linear Motion" from Conceptual Physics

Complete
complete each of the questions for the Chapter 3 Practice Test. You do not need to complete the problems.

- Chapter 3 Practice Test

Complete

Complete

- Lesson 6d: "Sample Problems and Solutions"

Refer to previous lessons within Physics Classroom as necessary.

Newton’s Laws of Motion
Work through the activities listed in this topic to gain an understanding of the meaning of force, different ways to categorize force, and Newton’s Laws of Motion. You will learn to conceptualize how each law defines motion.

Read

- Chapter 2: "Newton's First Law of Motion—Inertia" from Conceptual Physics

Complete

Complete each of the questions for the Chapter 2 Practice Test. You do not need to complete the problems.

- Chapter 2 Practice Test

Review

- Lesson 2: "Force and Its Representation"

Read
Complete each of the questions for the Chapter 4 Practice Test. You do not need to complete the problems.

Read

Read Chapter 5: "Newton's Third Law of Motion" from Conceptual Physics

Complete each of the questions for the Chapter 5 Practice Test. You do not need to complete the problems.

Reflect

- What is the meaning of force?
- Describe several different types of forces (e.g., gravitational, normal, etc.).
- For each type of force mentioned, determine if it is a contact force or a force that acts at a distance.
- For each of Newton's Laws of Motion, state the law and describe a situation that exhibits the law.

You are encouraged to contact the course instructor and discuss these.

Applications of Motion

Work through the activities in this topic to gain an understanding of motion and forces in two dimensions. You will learn how to separate a vector into components and use free-body diagrams to solve projectile motion problems and other problems that involve motion and forces.

Read

Read the following lessons in "Vectors – Motion and Forces in Two Dimensions"

- Lesson 1 "Vectors: Fundamentals and Operations"
- Lesson 2 "Projectile Motion"
- Lesson 3 "Forces in Two Dimensions"

Do

- Create an example problem that involves a drag force (e.g., air resistance or friction), inclined planes, or projectile motion. Post your problem on the message board and solve problems posted by other students.

Mechanics, Part II

In this section, you will continue to learn about the laws that govern linear and rotational motion, forces, momentum, energy, and gravity.
Momentum

Work through the activities in this topic to gain understanding of inertia, momentum, and impulse. You will learn how these concepts relate and how to use these concepts to solve collision problems.

Read

- Chapter 6: "Momentum" from Conceptual Physics

Complete

Complete each of the questions for the Chapter 6 Practice Test. You do not need to complete the problems.

Energy

Work through the activities in this topic to gain an understanding of energy, power, and work. You will learn how these concepts relate, how to analyze energy transformations, and how to use the work-energy theorem to solve problems.

Read

- Chapter 7: "Energy" from Conceptual Physics

Complete

Complete each of the questions for the Chapter 7 Practice Test. You do not need to complete the problems.

Do

On a blank piece of paper list as many different types of energy as you can. Try to group them together into basic types. For example, wind and sound are both forms of kinetic energy.

Compare your list with the one at the following website:

- "Energy 101"

Review

- Lesson 2, parts a-e: "The Work-Energy Theorem"
Review

- What is the relationship between work and energy?
- What is the power required to provide 1000 J of work in 10 seconds?
- Describe the difference between potential and kinetic energy.
- Give an example of electromagnetic energy (light energy) being converted to chemical energy.
- Describe an example of using knowledge of work done on a system to determine the change in kinetic energy.

You are encouraged to contact your course instructor to discuss your answers.

**Rotational Motion**

Work through the activities in this topic to gain an understanding of rotational motion. You will learn how the concepts for rotational motion compare to linear motion.

**Read**

- Chapter 8: "Rotational Motion" from *Conceptual Physics*

**Complete**

Complete each of the questions for the Chapter 8 Practice Test. You do not need to complete the problems.

- Chapter 8 Practice Test

**Reflect**

- What is centripetal force and how does it affect the motion of an object?
- Explain the difference in how an observer in a rotating reference frame views centrifugal force as compared to an outside observer.
- Describe how mass, velocity, momentum, and the conservation of momentum compares with rotational inertia, rotational velocity, angular momentum, and the law of conservation of angular momentum.

You are encouraged to contact your course instructor to discuss your answers.

**Universal Law of Gravity**

Complete the activities in this topic to gain an understanding of the gravitational force. You will learn how to analyze the gravitational force between two bodies, and be able to conceptualize how the intensity of the force changes with distance.

**Read**

Chapter 9: "Gravity" from *Conceptual Physics*

- 9.1 ("The Universal Law of Gravity")
- 9.2 ("The Universal Gravitational Constant, G")
Complete

Complete each of the questions for the Chapter 9 Practice Test. You do not need to complete the problems.

Reflect

- How is the force of gravity between two objects affected if the mass of object A is doubled? If the mass of object B is doubled? If the distance between the two objects is doubled?

You are encouraged to contact your course instructor to discuss your answers.

Thermodynamics

Heat is the amount of energy transferred between two objects with different temperatures. Because heat is energy, it is not measured in degrees; instead, it is measured in Joules or calories. In this section, you will learn about temperature, heat, and the laws that govern the movement of heat.

Temperature and Heat

Work through the activities in this topic to gain an understanding of heat and how it relates to temperature and energy.

Read

Chapter 15: "Temperature, Heat, and Expansion" from Conceptual Physics

- 15.1 ("Temperature")
- 15.2 ("Heat")
- 15.3 ("Specific Heat Capacity")

Complete

Complete each of the questions for the Chapter 15 Practice Test. You do not need to complete the problems.

Reflect

- How are temperature and kinetic energy related?
- What is meant by the phrase, matter does not contain heat?
- Describe the relationship between internal energy, temperature, and heat.

You are encouraged to contact your course instructor to discuss your answers.

Heat Transfer

Work through the activities in this topic to gain an understanding of how heat is transferred from
one object to another.

**Read**

Chapter 16: "Heat Transfer" from *Conceptual Physics*

- **16.1 ("Conduction")**
- **16.2 ("Convection")**
- **16.3 ("Radiation")**

**Complete**

Complete each of the questions for the Chapter 16 Practice Test. You do not need to complete the problems.

- **Chapter 16 Practice Test**

**Thermodynamics**

Work through the activities in this topic to gain an understanding of the laws of thermodynamics. You will learn how each of the four laws is applied to everyday situations, including the principles of how a heat engine operates.

**Read**

- **Chapter 18: "Thermodynamics"** from *Conceptual Physics*

**Complete**

Complete each of the questions for the Chapter 18 Practice Test. You do not need to complete the problems.

- **Chapter 18 Practice Test**

**Review**

- "Thermal Equilibrium and the Zeroth Law of Thermodynamics" (not covered in the textbook)
- "Third Law of Thermodynamics"

**Reflect**

- State and give an example for each of the four laws of thermodynamics.
- Describe how a heat engine demonstrates the second law of thermodynamics.

You are encouraged to contact your course instructor to discuss your answers.

**Waves**

In this section, you will learn about the basic properties of waves and how they apply to simple harmonic motion, sound, and the Doppler effect.

**Do**

- **Period of a Pendulum Lab.** Download the Student Exploration Sheet under the "Lesson Info" tab at the top of the lab.
E-mail your experiment results recorded on the Student Exploration Sheet to the course instructor for review and feedback.

Read

Chapter 19: "Vibrations and Waves" from Conceptual Physics

- 19.1 ("Good Vibrations")
- 19.2 ("Wave Description")
- 19.3 ("Wave Motion")
- 19.4 ("Wave Speed")
- 19.5 ("Wave Interferences")
- 19.6 ("Doppler Effect")
- 19.7 ("Bow Waves")
- 19.8 ("Shock Waves")

Complete

Complete each of the questions for the Chapter 19 Practice Test. You do not need to complete the problems.

- [Chapter 19 Practice Test]

Review

- Lesson 0: "Vibrations"
- Lesson 4: "Formations of Standing Waves"

Complete

- "Waves and Vibrations" on the Physics Place website

Reflect

- Draw a wave on a piece of paper and label all of its attributes, including its wavelength, frequency, amplitude, period, crest, and trough.
- How are frequency and period related?
- What wave attributes are necessary to determine the speed of a wave?
- How does the restoring force change during simple harmonic motion?
- What factors influence the period of a pendulum?
- What is the difference between the two different types of waves caused by earthquakes?
- How are standing waves caused by interference?

You are encouraged to contact the course instructor and discuss your answers.

Doppler Effect

Complete the activities in this topic to gain an understanding of the Doppler effect.

Review

- Chapter 19: "Vibrations and Waves" from Conceptual Physics
19.6 ("Doppler Effect")
19.7 ("Bow Waves")
19.8 ("Shock Waves")

Watch

- "Doppler Effect Introduction" from Khan Academy

Sound

Complete the activities in this topic to gain an understanding of sound wave. You will learn how the speed of sound depends on the medium through which it travels.

Read

- Chapter 20: "Sound" from Conceptual Physics
  - 20.1 ("Nature of Sound")
  - 20.2 ("Sound in Air")

Complete

Complete each of the questions for the Chapter 20 Practice Test. You do not need to complete the problems.

- Chapter 20 Practice Test

Use the following widget from WolframAlpha to determine the speed of sound in various mediums:

- "Speed of Sound"

Reflect

- What is the difference between a compression and a rarefaction?
- Does sound travel faster in a vacuum, liquid, gas, or solid? Why?

You are encouraged to contact your course instructor to discuss your answers.

Electromagnetism

In this subject, you will learn about the laws, principles, and concepts that describe electrostatics, electric current, and magnetism. You will learn how these concepts are similar and related.

Electricity

Work through this topic to gain an understanding of electricity. You will learn how to determine the force between two charged particles and how to use the law of conservation of charge to solve problems.

Read

- Chapter 22: "Electrostatics" from Conceptual Physics

Complete
Complete each of the questions for the Chapter 22 Practice Test. You do not need to complete the problems.

- Chapter 22 Practice Test

**Electric Current**
Work through this topic to gain an understanding of electric current. You will learn how to create various types of circuits and how to relate ideas like voltage, current, and resistance.

**Read**

- Chapter 23: "Electric Current" from Conceptual Physics

**Complete**

Complete each of the questions for the Chapter 23 Practice Test. You do not need to complete the problems.

- Chapter 23 Practice Test

**Review**

Lesson 2: "Electric Current"

**Reflect and Do**

Pretend electrons are like cars on a freeway. In this analogy,

- What is the voltage?
- What is the current?
- What is the power?
- What is resistance?

Post your answer to the message board.

**Review**

- Lesson 4e: "Circuit Connections"

**Reflect**

- Describe how electric current, voltage, and resistance are related.
- Create an analogy, similar to the car analogy, between an electric circuit and the flow of water through pipes.
- Describe the speed and source of electrons in an electric circuit.
- Describe the difference between a parallel circuit and series circuit, including how to calculate the overall resistance of each.

You are encouraged to contact your course instructor and discuss your answers.

**Magnetism**

Complete the activities in this topic to gain an understanding of magnetism. You will learn about the properties of magnets, how electric charge is related to magnets, and the similarities
between electricity and magnetism.

Read

- Chapter 24: "Magnetism" from Conceptual Physics

Complete each of the questions for the Chapter 24 Practice Test. You do not need to complete the problems.

- Chapter 24 Practice Test

Reflect

- How is electric charge related to a magnetic force?
- Where is the motion of electric charge in a bar magnet?
- Does every magnet have both a north and south pole?
- How do the rules for the attraction or repulsion between two magnets compare to the attraction or repulsion between two charges?

You are encouraged to contact your course instructor and discuss your answers.

Inverse Square Law

Complete the activities in this topic to gain an understanding of the inverse square law. You will learn to identify applications that follow the inverse square law and how it relates these concepts together.

Read

- Chapter 9: "Gravity" from Conceptual Physics
  - 9.3 ("Gravity and Distance: The Inverse-Square Law")
- Chapter 22: "Electrostatics" from Conceptual Physics
  - 22.4 ("Coulomb's Law")

Review

- "Inverse Square Law, General"

Reflect

- What do all of the various applications that obey the inverse square law have in common?
- How does the source spread?
- How is this different from stretching a spring?

Do

Write down an example of a force that follows the inverse square law and is not mentioned in this activity. You may need to look through your book or search the internet. Post what you find to the message board.

Light
In this section, you will study the properties and applications of light. You will learn how electromagnetic waves are produced and how to solve problems related to light encountering material boundaries.

**Electromagnetic Waves**

Complete the activities to gain an understanding of electromagnetic waves. You will learn how electromagnetic waves are produced, the significance of their speed, and how they are categorized in the electromagnetic spectrum.

**Read**

- Chapter 26: "Properties of Light" from *Conceptual Physics*
  - 26.1 ("Electromagnetic Waves")
  - 26.2 ("Electromagnetic Wave Velocity")
  - 26.3 ("The Electromagnetic Spectrum")
  - 26.4 ("Transparent Materials")
  - 26.5 ("Opaque Materials")

**Complete**

Complete each of the questions for the Chapter 26 Practice Test. You do not need to complete the problems.

- Chapter 26 Practice Test

**Reflect**

- How are the directions of the electric and magnetic fields that make up an electromagnetic wave related to each other and the direction of the wave itself?
- What principle is responsible for electromagnetic waves always traveling at the speed of light in a vacuum?
- What is the difference between a radio wave and light?
- What electromagnetic waves have the lowest frequency? Highest frequency? Shortest wavelength? Longest wavelength?
- Does light travel faster in a vacuum, air, or glass?

You are encouraged to contact your course instructor to discuss your answers.

**Application of Light**

Complete the activities in this topic to gain an understanding of the application of light. You will learn how to analyze situations that include the reflection, refraction, diffraction, and/or scattering of light.

**Read**

- Chapter 27: "Color" from *Conceptual Physics*

**Complete**

Complete each of the questions for the Chapter 27 Practice Test. You do not need to complete the problems.
Read

- Chapter 27 Practice Test

Complete each of the questions for the Chapter 28 Practice Test. You do not need to complete the problems.

Read

- Chapter 28: "Reflection and Refraction" from Conceptual Physics

Complete

Complete each of the questions for the Chapter 29 Practice Test. You do not need to complete the problems.

Reflect

- How do the absorbing and emitting properties of a material determine its color?
- Why is the sky blue?
- What causes an object that is partially in water to appear as if it is bent?
- What causes a very small object viewed with a microscope to blur?
- How do the shape of a mirror and the location of the object affect the image?
- How do the shape of a lens and the location of the object affect the image?

You are encouraged to contact your course instructor to discuss your answers.

Modern Physics

In this subject, you will learn about nuclear physics, including radiation, and the special theory of relativity.

Radioactivity

Complete the activities in this topic to gain an understanding of the atomic nucleus and radioactivity. You will learn about the various types of radiation and how to solve problems involving the half-life of elements.

Read

- Chapter 33: "Atomic Nucleus and Radioactivity" from Conceptual Physics
  - 33.1 ("X-rays and Radioactivity")
  - 33.2 ("Alpha, Beta, and Gamma Rays")
  - 33.5 ("Radioactive Half-Life")
Complete

Complete each of the questions for the Chapter 33 Practice Test. You do not need to complete the problems.

- Chapter 33 Practice Test

Watch

- Radioactive Decay Lab Video

You may want to open the periodic table for reference while watching the video.

Reflect

- Which type of radiation is made up of particles?
- Which type of radiation has an electrical charge?
- Which type of radiation is the most harmful?
- What is meant by the half-life of an element?

You are encouraged to contact your course instructor to discuss your answers.

Nuclear Fission and Fusion

Complete the activities in this topic to gain an understanding of nuclear fission and fusion. You will learn about how these concepts relate and how they can be used to create nuclear power.

Read

- Chapter 34: "Nuclear Fission and Fusion" in Conceptual Physics

Complete

Complete each of the questions for the Chapter 34 Practice Test. You do not need to complete the problems.

- Chapter 34 Practice Test

Reflect

- What is the difference between nuclear fission and nuclear fusion?
- What are the advantages and disadvantages of nuclear power?

You are encouraged to contact your course instructor to discuss your answers.

Special Theory of Relativity

Complete the activities in this topic to gain an understanding of the special theory of relativity. You will learn about Einstein's postulates and how they explain why distance and time are altered as a body travels near the speed of light.

Read

- Chapter 35: "Special Theory of Relativity" in Conceptual Physics

Complete
Complete each of the questions for the Chapter 5 Practice Test. You do not need to complete the problems.

- **Chapter 35 Practice Test**

**Do**

Using what you know about relativity, watch a science fiction television show (e.g., Star Trek), or at least remember back to episodes you have previously seen.

- What would really happen as a spacecraft approached light speed?
- How would that look to us?

**Reflect**

- How does Einstein's second postulate relate to the concept of simultaneity?
- What are time dilation and length contraction?
- What is the meaning/significance of Einstein's famous formula that relates mass and energy?

You are encouraged to contact your course instructor to discuss your answers.

**Final Steps**

Congratulations on completing the activities in the Conceptual Physics course! As you can appreciate, physics requires a deep conceptual understanding of a broad range of topics. Your studies focused on mechanics, waves, thermodynamics, electricity and magnetism, light, and modern physics.

This section will guide you through the assessment process.

**Accessing Objective Assessments**

The activities in this course of study have prepared you to complete the C876 objective assessment. If you have not already completed this assessment, you will do so now.

**Accessing Objective Assessments**

The activities in this course have prepared you to complete the C876 objective assessment. If you have not already been directed to complete the assessments, schedule and complete your assessments now.