DREYFOUS & ASSOCIATES

Course Overview

Physics

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Unit 1. A Physics Toolkit

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. A Physics Toolkit

Code: C415G0SU01L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Methods of Science

Code: C415G0SU01L01

Essential questions

- What are the characteristics of scientific methods?
- Why do scientists use models?
- What is the difference between a scientific theory and a scientific law?
- What are some limitations of science?

Concepts

- hypothesis
- model
- physics
- scientific law
- scientific methods
- scientific theory

Lesson 2. Mathematics and Physics

Code: C415G0SU01L02

Essential questions

- Why do scientists use the metric system?
- How can dimensional analysis help evaluate answers?
- What are significant figures?

Concepts

- dimensional analysis
- significant figures

Lesson 3. Measurement

Code: C415G0SU01L03

Essential questions

- Why are the results of measurements often reported with an uncertainty?
- What is the difference between precision and accuracy?
- What is a common source of error when making a measurement?

Concepts

- accuracy

- measurement
- precision

Lesson 4. Graphing Data

Code: C415G0SU01L04

Essential questions

- What can be learned from graphs?
- What are some common relationships in graphs?
- How do scientists make predictions?

Concepts

- dependent variable
- independent variable
- inverse relationship
- line of best fit
- linear relationship
- quadratic relationship

Unit 2. Representing Motion

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Representing Motion

Code: C415G0SU02L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Picturing Motion

Code: C415G0SU02L01

Essential questions

- How do motion diagrams represent motion?
- How can you use a particle model to represent a moving object?

Concepts

- motion diagram
- particle model

Lesson 2. Where and When?

Code: C415G0SU02L02

Essential questions

- What is a coordinate system?
- How does the chosen coordinate system affect the sign of objects' positions?
- How are time intervals measured?
- What is displacement?
- How are motion diagrams helpful in answering questions about an object's position or displacement?

Concepts

- coordinate system
- displacement
- distance
- magnitude
- origin
- position
- resultant
- scalar
- time interval
- vector

Lesson 3. Position-Time Graphs

Code: C415G0SU02L03

Essential questions

- What information do position-time graphs provide?
- How can you use a position-time graph to interpret an object's position or displacement?
- What are the purposes of equivalent representations of an object's motion?

Concepts

- instantaneous position
- position-time graph

Lesson 4. How Fast?

Code: C415G0SU02L04

Essential questions

- What is velocity?
- What is the difference between speed and velocity?
- How can you determine an object's average velocity from a position-time graph?
- How can you represent motion with pictorial, physical, and mathematical models?

Concepts

- average speed
- average velocity
- instantaneous velocity

Unit 3. Accelerated Motion

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Accelerated Motion

Code: C415G0SU03L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Acceleration

Code: C415G0SU03L01

Essential questions

- What is acceleration?
- How is acceleration different from velocity?
- What information can you learn from velocity-time graphs?

Concepts

- acceleration
- average acceleration
- instantaneous acceleration
- velocity-time graph

Lesson 2. Motion with Constant Acceleration

Code: C415G0SU03L02

Essential questions

- What do a position-time graph and a velocity-time graph look like for motion with constant acceleration?
- How can you determine the displacement of a moving object from its velocity-time graph?
- What are the relationships among position, velocity, acceleration, and time?

Concepts

- average acceleration
- constant Acceleration

Lesson 3. Free Fall

Code: C415G0SU03L03

Essential questions

- What is free-fall acceleration?
- How do objects in free fall move?

Concepts

- free fall
- free-fall acceleration

Unit 4. Forces in One Dimension

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Forces in One Dimension

Code: C415G0SU04L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Force and Motion

Code: C415G0SU04L01

Essential questions

- What is a force?
- What is the relationship between force and acceleration?
- How does motion change when the net force is zero?

Concepts

- equilibrium
- force
- free-body diagram
- inertia
- net force
- Newton's first law
- Newton's second law
- system

Lesson 2. Weight and Drag Force

Code: C415G0SU04L02

Essential questions

- How are the weight and the mass of an object related?
- How do actual weight and apparent weight differ?
- What effect does air have on falling objects?

Concepts

- apparent weight
- drag force
- gravitational field
- terminal velocity
- weight
- weightlessness

Lesson 3. Newton's Third Law

Code: C415G0SU04L03

Essential questions

- What is Newton's third law?

- What is the normal force?

Concepts

- interaction pair
- Newton's third law
- normal force
- tension

Unit 5. Displacement and Force in Two Dimensions

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Displacement and Force in Two Dimensions

Code: C415G0SU05L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Vectors

Code: C415G0SU05L01

Essential questions

- How are vectors added graphically?
- What are the components of a vector?
- How are vectors added algebraically?

Concepts

- components
- vector resolution

Lesson 2. Friction

Code: C415G0SU05L02

Essential questions

- What is the friction force?
- How do static and kinetic friction differ?

Concepts

- coefficient of kinetic friction
- coefficient of static friction
- kinetic friction
- static friction

Lesson 3. Forces in Two Dimensions

Code: C415G0SU05L03

Essential questions

- How can you find the force required for equilibrium?
- How do you resolve force vector components for motion along an inclined plane?

Concept

- equilibrant

Unit 6. Motion in Two Dimensions

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Motion in Two Dimensions

Code: C415G0SU06L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Projectile Motion

Code: C415G0SU06L01

Essential questions

- How are the vertical and horizontal motions of a projectile related?
- What are the relationships between a projectile's height, time in the air, initial velocity, and horizontal distance traveled?

Concepts

- projectile
- trajectory

Lesson 2. Circular Motion

Code: C415G0SU06L02

Essential questions

- Why is an object moving in a circle at a constant speed accelerating?
- How does centripetal acceleration depend upon the object's speed and the radius of the circle?
- What causes centripetal acceleration?

Concepts

- centripetal acceleration
- centripetal force
- uniform circular motion

Lesson 3. Relative Velocity

Code: C415G0SU06L03

Essential questions

- What is relative velocity?
- How do you find the velocities of an object in different reference frames?

Concept

- reference frame

Unit 7. Gravitation

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Gravitation

Code: C415G0SU07L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Planetary Motion and Gravitation

Code: C415G0SU07L01

Essential questions

- What is the relationship between a planet's orbital radius and period?
- What is Newton's law of universal gravitation, and how does it relate to Kepler's laws?
- Why was Cavendish's investigation important?

Concepts

- gravitational force
- Kepler's first law
- Kepler's second law
- Kepler's third law
- law of universal gravitation

Lesson 2. Using the Law of Universal Gravitation

Code: C415G0SU07L02

Essential questions

- How can you describe orbital motion?
- How are gravitational mass and inertial mass alike, and how are they different?
- How is gravitational force explained, and what did Einstein propose about gravitational force?

Concepts

- gravitational mass
- inertial mass

Unit 8. Rotational Motion

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Rotational Motion

Code: C415G0SU08L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Describing Rotational Motion

Code: C415G0SU08L01

Essential questions

- What is angular displacement?
- What is average angular velocity?
- What is average angular acceleration, and how is it related to angular velocity?

Concepts

- angular acceleration
- angular displacement
- angular velocity
- radian

Lesson 2. Rotational Dynamics

Code: C415G0SU08L02

Essential questions

- What is torque?
- How is the moment of inertia related to rotational motion?
- How are torque, the moment of inertia, and Newton's second law for rotational motion related?

Concepts

- lever arm
- moment of inertia
- Newton's second law for rotational motion
- torque

Lesson 3. Equilibrium

Code: C415G0SU08L03

Essential questions

- What is center of mass?
- How does the location of the center of mass affect the stability of an object?
- What are the conditions for equilibrium?

- How do rotating frames of reference give rise to apparent forces?

Concepts

- center of mass
- centrifugal “force”
- coriolis “force”

Unit 9. Momentum and Its Conservation

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Momentum and Its Conservation

Code: C415G0SU09L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Impulse and Momentum

Code: C415G0SU09L01

Essential questions

- What is impulse?
- What is momentum?
- What is angular momentum?

Concepts

- angular momentum
- angular impulse-angular momentum theorem
- impulse
- impulse-momentum theorem
- momentum

Lesson 2. Conservation of Momentum

Code: C415G0SU09L02

Essential questions

- How does Newton's third law relate to conservation of momentum?
- Under which conditions is momentum conserved?
- How can the law of conservation of momentum and the law of conservation of angular momentum help explain the motion of objects?

Concepts

- closed system
- isolated system
- law of conservation of momentum
- law of conservation of angular momentum

Unit 10. Work, Energy, and Machines

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Work, Energy, and Machines

Code: C415G0SU10L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Work and Energy

Code: C415G0SU10L01

Essential questions

- What is work?
- What is energy?
- How are work and energy related?
- What is power, and how is it related to work and energy?

Concepts

- energy
- joule
- kinetic energy
- power
- translational kinetic energy
- work-energy theorem
- work
- watt

Lesson 2. Machines

Code: C415G0SU10L02

Essential questions

- What is a machine, and how does it make tasks easier?
- How are mechanical advantage, the effort force, and the resistance force related?
- What is a machine's ideal mechanical advantage?
- What does the term efficiency mean?

Concepts

- compound machine
- effort force
- efficiency
- ideal mechanical advantage
- machine
- mechanical advantage
- resistance force

Unit 11. Energy and Its Conservation

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Energy and Its Conservation

Code: C415G0SU11L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. The Many Forms of Energy

Code: C415G0SU11L01

Essential questions

- How is a system's motion related to its kinetic energy?
- What is gravitational potential energy?
- What is elastic potential energy?
- How are mass and energy related?

Concepts

- elastic potential energy
- gravitational potential energy
- potential energy
- reference level
- rotational kinetic energy
- thermal energy

Lesson 2. Conservation of Energy

Code: C415G0SU11L02

Essential questions

- Under what conditions is energy conserved?
- What is mechanical energy, and when is it conserved?
- How are momentum and kinetic energy conserved or changed in a collision?

Concepts

- elastic collision
- inelastic collision
- law of conservation of energy
- mechanical energy

Unit 12. Thermal Energy

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Thermal Energy

Code: C415G0SU12L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Temperature, Heat, and Thermal Energy

Code: C415G0SU12L01

Essential questions

- How are temperature and thermal energy related?
- How are thermal equilibrium and temperature related?
- How is thermal energy transferred?
- What is specific heat?

Concepts

- convection
- heat
- radiation
- specific heat
- thermal conduction
- thermal equilibrium

Lesson 2. Changes of State and Thermodynamics

Code: C415G0SU12L02

Essential questions

- How are the heats of fusion and vaporization related to changes in state?
- What is the first law of thermodynamics?
- How do engines, heat pumps, and refrigerators demonstrate the first law of thermodynamics?
- What is the second law of thermodynamics?

Concepts

- entropy
- first law of thermodynamics
- heat engine
- heat of fusion
- heat of vaporization
- second law of thermodynamics

Unit 13. States of Matter

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. States of Matter

Code: C415G0SU13L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Properties of Fluids

Code: C415G0SU13L01

Essential questions

- What is a fluid?
- What are the relationships among the pressure, volume, and temperature of a gas?
- What is the ideal gas law?
- What is plasma?

Concepts

- combined gas law
- fluid
- ideal gas law
- pascal
- plasma
- pressure
- thermal expansion

Lesson 2. Forces Within Liquids

Code: C415G0SU13L02

Essential questions

- What is surface tension?
- What is capillary action?
- How do clouds form?

Concepts

- adhesive forces
- cohesive forces

Lesson 3. Fluids at Rest and in Motion

Code: C415G0SU13L03

Essential questions

- What is Pascal's principle?
- How does Archimedes' principle apply to buoyancy?
- What is the role of Bernoulli's principle in airflows?

Concepts

- Archimedes' principle
- Bernoulli's principle
- buoyant force
- Pascal's principle
- Streamlines

Lesson 4. Solids

Code: C415G0SU13L04

Essential questions

- How do a solid's properties relate to that solid's structure?
- Why do solids expand and contract when the temperature changes?
- Why is thermal expansion important?

Concepts

- amorphous solid
- coefficient of linear expansion
- coefficient of volume expansion
- crystal lattice

Unit 14. Vibrations and Waves

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Vibrations and Waves

Code: C415G0SU14L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Periodic Motion

Code: C415G0SU14L01

Essential questions

- What is simple harmonic motion?
- How much energy is stored in a spring?
- What affects a pendulum's period?

Concepts

- amplitude
- Hooke's law
- periodic motion
- period
- resonance
- simple harmonic motion
- simple pendulum

Lesson 2. Wave Properties

Code: C415G0SU14L02

Essential questions

- What are waves?
- How do transverse and longitudinal waves compare?
- What is the relationship between wave speed, wavelength, and frequency?

Concepts

- crest
- frequency
- longitudinal wave
- periodic wave
- surface wave
- transverse wave
- trough
- wave
- wave pulse
- wavelength

Lesson 3. Wave Behavior

Code: C415G0SU14L03

Essential questions

- How are waves reflected and refracted at boundaries between mediums?
- How does the principle of superposition apply to the phenomenon of interference?

Concepts

- antinode
- incident wave
- interference
- law of reflection
- node
- normal
- principle of superposition
- ray
- reflected wave
- refraction
- standing wave
- wavefront

Unit 15. Sound

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Sound

Code: C415G0SU15L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Properties and Detection of Sound

Code: C415G0SU15L01

Essential questions

- What properties does sound share with other waves?
- How do the physical properties of sound waves relate to our perception of sound?
- What is the Doppler effect?
- What are some applications of the Doppler effect?

Concepts

- decibel
- Doppler effect
- loudness
- pitch
- sound level
- sound wave

Lesson 2. The Physics of Music

Code: C415G0SU15L02

Essential questions

- What is the origin of sound?
- What are the characteristics of resonance in air columns?
- What are the characteristics of resonance on strings?
- Why are there variations in sound quality among instruments?
- How are beats produced?

Concepts

- beat
- closed-pipe resonator
- consonance
- dissonance
- fundamental
- harmonics
- open-pipe resonator

Unit 16. Fundamentals of Light

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Fundamentals of Light

Code: C415G0SU16L00

Unit Documents: Assessment, Physics That is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Illumination

Code: C415G0SU16L01

Essential questions

- What is the ray model of light?
- How are distance and illumination related?
- How was the speed of light determined?

Concepts

- illuminance
- luminous flux
- luminous source
- opaque
- ray model of light
- translucent
- transparent

Lesson 2. The Wave Nature of Light

Code: C415G0SU16L02

Essential questions

- How does diffraction demonstrate that light has wave properties?
- What are the effects of combining colors of light and mixing pigments?
- How do phenomena such as polarization and the Doppler effect occur?

Concepts

- complementary color
- diffraction
- Malus's law
- polarization
- primary color
- primary pigment
- secondary color
- secondary pigment

Unit 17. Reflection and Mirrors

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Reflection and Mirrors

Code: C415G0SU17L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Plane Mirrors

Code: C415G15U17L01

Essential questions

- What is the law of reflection?
- What is the difference between specular and diffuse reflection?
- How can the images formed by plane mirrors be located?

Concepts

- diffuse reflection
- image
- object
- plane mirror
- specular reflection
- virtual image

Lesson 2. Curved Mirrors

Code: C415G15U17L02

Essential questions

- What are some properties and uses of spherical concave mirrors?
- How are ray diagrams used to describe images produced by curved mirrors?
- How are convex mirrors and combinations of mirrors used?
- How can you calculate properties of images produced by curved mirrors?

Concepts

- concave mirror
- convex mirror
- focal length
- focal point
- magnification
- principal axis
- real image
- spherical aberration

Unit 18. Refraction and Lenses

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Refraction and Lenses

Code: C415G0SU18L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Refraction of Light

Code: C415G0SU18L01

Essential questions

- What is Snell's law of refraction?
- What is the meaning of the index of refraction?
- How does total internal reflection occur?
- How does refraction cause various optical effects?

Concepts

- critical angle
- dispersion
- index of refraction
- total internal reflection

Lesson 2. Convex and Concave Lenses

Code: C415G0SU18L02

Essential questions

- How are real and virtual images formed by single convex and concave lenses?
- How can images formed by lenses be located and described with ray diagrams and equations?
- How can chromatic aberration be reduced?

Concepts

- achromatic lens
- chromatic aberration
- concave lens
- convex lens
- lens
- thin lens equation

Lesson 3. Applications of Lenses

Code: C415G0SU18L03

Essential questions

- How does the eye focus light to form an image?

- What are nearsightedness and farsightedness, and how can eyeglass lenses correct these defects?
- What are the characteristics of the optical systems in some common optical instruments?

Concepts

- farsightedness
- nearsightedness

Unit 19. Interference and Diffraction

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Interference and Diffraction

Code: C415G0SU19L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Interference

Code: C415G0SU19L01

Essential questions

- How does light falling on two slits produce an interference pattern?
- How can you use an interference pattern to find the wavelength of light?
- How can modeling techniques be applied to thin-film interference?

Concepts

- coherent light
- incoherent light
- interference fringes
- monochromatic light
- thin-film interference

Lesson 2. Diffraction

Code: C415G0SU19L02

Essential questions

- What affects the width of the bright central band in a single-slit diffraction pattern?
- How do diffraction gratings form diffraction patterns?
- How are diffraction gratings used in diffraction grating spectrometers?
- How does diffraction limit the ability to distinguish two closely spaced objects with a lens?

Concepts

- diffraction pattern
- diffraction grating
- Rayleigh criterion

Unit 20. Static Electricity

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Static Electricity

Code: C415G0SU20L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Electric Charge

Code: C415G0SU20L01

Essential questions

- How can you demonstrate that charged objects exert forces, both attractive and repulsive?
- How do we know that charging is the separation, not the creation, of electric charges?
- What are the differences between conductors and insulators?

Concepts

- conductor
- electrostatics
- insulator
- neutral

Lesson 2. Electrostatic Force

Code: C415G0SU20L02

Essential questions

- How does the electrostatic force depend on the distance between charges?
- How can you charge objects by conduction and by induction?
- What is Coulomb's law, and how is it used?

Concepts

- charging by conduction
- charging by induction
- coulomb
- Coulomb's law
- electroscope
- elementary charge
- grounding

Unit 21. Electric Fields

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Electric Fields

Code: C415G0SU21L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Measuring Electric Fields

Code: C415G0SU21L01

Essential questions

- What is an electric field?
- How are charge, electric field, and forces on charged objects related?
- How can you represent electric fields in diagrams and other models?

Concepts

- electric field
- electric field line

Lesson 2. Applications of Electric Fields

Code: C415G0SU21L02

Essential questions

- What is an electric potential difference?
- How is potential difference related to the work required to move a charge?
- What are properties of capacitors?

Concepts

- capacitor
- capacitance
- electric potential difference
- equipotential
- volt

Unit 22. Electric Current

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Electric Current

Code: C415G0SU22L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Current and Circuits

Code: C415G0SU22L01

Essential questions

- What is electric current?
- How does energy change in electric circuits?
- What is Ohm's law?
- How are power, current, potential difference, and resistance mathematically related?

Concepts

- ampere
- battery
- conventional current
- electric circuit
- electric current
- parallel connection
- resistance
- resistor
- series connection

Lesson 2. Using Electrical Energy

Code: C415G0SU22L02

Essential questions

- How is electrical energy transformed into thermal energy?
- How are electrical energy and power related?
- How is electrical energy transmitted with as little thermal energy transformation as possible?

Concepts

- kilowatt-hour
- superconductor

Unit 23. Series and Parallel Circuits

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Series and Parallel Circuits

Code: C415G0SU23L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Simple Circuits

Code: C415G0SU23L01

Essential questions

- What are the characteristics of series and parallel circuits?
- How are currents, potential differences, and equivalent resistances in series circuits related?
- How are currents, potential differences, and equivalent resistances in parallel circuits related?

Concepts

- equivalent resistance
- parallel circuit
- series circuit
- voltage divider

Lesson 2. Applications of Circuits

Code: C415G0SU23L02

Essential questions

- How do fuses, circuit breakers, and ground-fault interrupters protect household wiring?
- How can you find currents and potential differences in combined series-parallel circuits?
- How do you use voltmeters and ammeters to measure potential differences and currents in circuits?

Concepts

- circuit breaker
- combination series-parallel circuit
- fuse
- ground-fault interrupter
- short circuit

Unit 24. Magnetic Fields

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Magnetic Fields

Code: C415G0SU24L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Understanding Magnetism

Code: C415G0SU24L01

Essential questions

- What are some properties of magnets?
- What causes an object to be magnetic?
- What are the characteristics of magnetic fields?
- What is the relationship between magnetic fields and electric currents?

Concepts

- domain
- electromagnet
- magnetic field
- magnetic flux
- polarized
- solenoid

Lesson 2. Applying Magnetic Forces

Code: C415G0SU24L02

Essential questions

- How is the direction of the force on a current-carrying wire related to the direction of the magnetic field?
- What affects the force on a current carrying wire in a magnetic field?
- What are the characteristics of the design and operation of an electric motor?
- What affects the force on a charged particle moving in a magnetic field?

Concepts

- armature
- electric motor
- galvanometer

Unit 25. Electromagnetic Induction

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Electromagnetic Induction

Code: C415G0SU25L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Inducing Currents

Code: C415G0SU25L01

Essential questions

- What is induced EMF?
- What affects the induced EMF and current produced by a changing magnetic field?
- How does a generator produce electrical energy?
- How are the effective current and effective potential difference related to the maximum values of these quantities in an AC circuit?

Concepts

- electric generator
- electromagnetic induction
- induced electromotive force

Lesson 2. Applications of Induced Currents

Code: C415G0SU25L02

Essential questions

- What is Lenz's law and how is it related to induced EMFs?
- How do induced EMFs affect the operation of motors and generators?
- What is self-inductance, and how does it affect circuits?
- How does the turns ratio in a transformer affect potential difference and current?

Concepts

- eddy current
- Lenz's law
- mutual inductance
- self-inductance
- step-down transformer
- step-up transformer
- transformer

Unit 26. Electromagnetism

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Electromagnetism

Code: C415G0SU26L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Electric and Magnetic Forces on Particles

Code: C415G0SU26L01

Essential questions

- How did nineteenth century physicists measure the charge-to-mass ratio and the mass of the electron?
- How can you determine velocities of particles in electric and magnetic fields, and how can you find the charge-to-mass ratios of the particles?
- How does a mass spectrometer separate ions of different masses?

Concepts

- isotope
- mass spectrometer

Lesson 2. Electric and Magnetic Fields in Space

Code: C415G0SU26L02

Essential questions

- How do electromagnetic waves propagate through space?
- How does the speed at which electromagnetic waves propagate through different materials vary?
- How do electromagnetic waves transmit information?
- What factors affect an antenna's sensitivity to electromagnetic waves of given wavelengths?

Concepts

- antenna
- carrier wave
- dielectric
- electromagnetic radiation
- electromagnetic spectrum
- electromagnetic wave
- piezoelectricity
- receiver
- transmitter

Unit 27. Quantum Theory

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Quantum Theory

Code: C415G0SU27L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. A Particle Model of Waves

Code: C415G0SU27L01

Essential questions

- What are the characteristics of the electromagnetic spectrum emitted by an object?
- What is the photoelectric effect?
- What is the Compton effect?

Concepts

- compton effect
- emission spectrum
- photoelectric effect
- photon
- quantized
- threshold frequency
- work function

Lesson 2. Matter Waves

Code: C415G0SU27L02

Essential questions

- What is the evidence for the wave nature of matter?
- What is the dual nature of waves and particles, and what is the importance of the Heisenberg uncertainty principle?

Concepts

- de Broglie wavelength
- Heisenberg uncertainty principle

Unit 28. The Atom

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. The Atom

Code: C415G0SU28L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Bohr's Model of the Atom

Code: C415G0SU28L01

Essential questions

- What did Rutherford's experiment reveal about the structure of the atom?
- What are emission spectra and absorption spectra?
- How do the radius and energy of electron orbitals depend on the principal quantum number?

Concepts

- absorption spectrum
- alpha particles
- energy level
- excited state
- ground state
- nucleus
- principal quantum number

Lesson 2. The Quantum Model of the Atom

Code: C415G0SU28L02

Essential questions

- What are the characteristics of the quantum model of the atom?
- How does a laser work?
- What are the properties of laser light?

Concepts

- electron cloud
- laser
- quantum mechanics
- quantum model
- stimulated emission

Unit 29. Solid-State Electronics

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Solid-State Electronics

Code: C415G0SU29L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. Conduction in Solids

Code: C415G0SU29L01

Essential questions

- How does the band theory of solids explain conduction?
- How do the energy levels in conductors, insulators, and semiconductors vary?
- How can the conductivity of a semiconductor be improved?
- How are n-type and *p*-type semiconductors alike? How are they different?

Concepts

- band theory
- dopant
- extrinsic semiconductor
- intrinsic semiconductor
- semiconductor

Lesson 2. Electronic Components

Code: C415G0SU29L02

Essential questions

- What is a diode?
- What are some uses of diodes?
- What is a transistor?
- What is the major function of a transistor?

Concepts

- depletion layer
- diode
- microchip
- transistor

Unit 30. Nuclear and Particle Physics

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Nuclear and Particle Physics

Code: C415G0SU30L00

Unit Documents: Assessment, Physics that is Entertainment, Standardized Test Practice, Study Guide and others.

Lesson 1. The Nucleus

Code: C415G0SU30L01

Essential questions

- What properties does the nucleus of an atom have?
- In what ways do the nuclei of isotopes differ?
- What force holds the nucleus together?
- What are the binding energy and the mass defect of the nucleus?
- How is the mass defect of a nucleus related to the binding energy?

Concepts

- atomic mass unit
- atomic number
- binding energy
- mass defect
- mass number
- nucleon
- strong nuclear force

Lesson 2. Nuclear Decay and Reactions

Code: C415G0SU30L02

Essential questions

- What are some characteristics of the main types of radioactive decay?
- What is an isotope's half-life?
- How does nuclear fission release energy? How is this used in a nuclear reactor?
- How does nuclear fusion release energy?

Concepts

- activity
- alpha decay
- beta decay
- chain reaction
- fission
- fusion
- gamma decay
- half-life
- nuclear reaction

- radioactive

Lesson 3. The Building Blocks of Matter

Code: C415G0SU30L03

Essential questions

- How are particles produced and detected?
- What are the characteristics of the Standard Model of matter?
- How are mass and other forms of energy transformed during pair annihilation and production?
- What is the role of the weak nuclear force?

Concepts

- force carrier
- lepton
- pair production
- quark
- standard Model
- weak nuclear force