

Science Engineering Curriculum Guide 2001

FREEHOLD REGIONAL COURSE PROFICIENCIES HIGH SCHOOL DISTRICT SCIENCE/ENGINEERING PHYSICS

Students enrolled in this course will demonstrate mastery of the following proficiency requirements as outlined in the curriculum guide and receive a passing grade in accordance with Board of Education policies on grading and attendance:

1. Understand and apply the MKS, CGS, and English systems of units to appropriate physics problems.
2. Demonstrate the ability to successfully complete appropriate laboratory experiments including: data collection, data organization, data analysis, error analysis, conclusion drawing and the development of appropriate scientific models.
3. Demonstrate knowledge of and adherence to safety rules in the science laboratory.
4. Demonstrate the ability to analyze data through graphical techniques including: the development of appropriate equations and the application of integral and differential calculus to the relationships between graphs.
5. Demonstrate the ability to solve appropriate physics problems using vector analysis.
6. Demonstrate a thorough understanding of the mechanical concepts of force, displacement, velocity, and acceleration, and their applications to real world problems.
7. Demonstrate a thorough understanding of Newton's three Laws of Motion and their application to problems in mechanical systems.
8. Demonstrate the ability to use both momentum, energy conservation and the Work-Energy Theorem in the solving of appropriate physics problems.
9. Demonstrate the ability to apply mechanical concepts and conservation laws to systems in rotary motion.
10. * Demonstrate a thorough knowledge of simple machines including both mechanical advantage and mechanical efficiency.
11. Demonstrate an understanding of damped and undamped simple harmonic motion, its relationship to rotary motion, the effects of forced oscillations and the relationship of SHM to real world physical problems.
12. Demonstrate a thorough familiarity with the characteristics and properties of mechanical waves including; reflection, refraction, diffraction, interference and polarization.
13. Demonstrate an understanding of sound, its wave nature and its measurable characteristics.
14. Demonstrate a familiarity with the classical development of the theories of light and the measurement of its intensity and speed.
15. Demonstrate an understanding of the wave nature of light including its ability to reflect, refract, diffract, interfere and to be polarized.
16. Demonstrate an understanding of ray optics in both lenses and mirrors including;
 - a. the qualitative determination of the position of real and virtual images through ray diagrams.
 - b. the quantitative prediction of the position and magnification of real and virtual images.
 - c. determining the focal lengths of mirrors and lenses [through the lensmaker's equation].
17. Demonstrate an understanding of the conflicting evidence [Michelson-Morley Interferometer, Photoelectric Effect and Blackbody Radiation] regarding light, its interaction with the environment and the resulting wave-particle duality theory.
18. * Demonstrate an understanding of electrostatics including the relationships among electric fields, forces and potentials.
19. * Demonstrate the ability to use Gauss's Law in the determination of the electric fields near point sources, spheres, planes and cylinders for both conducting and insulating bodies.
20. * Demonstrate the ability to determine the capacitance of capacitors of various designs including parallel plate, spherical shell and cylindrical shell with and without the presence of an insulating medium.
21. * Demonstrate an understanding of the use and function of capacitors in series, parallel and in combined electrical circuits.
22. * Demonstrate the ability to evaluate simple DC circuits through the use of Ohm's Law, Kirchoff's Laws and other applicable principles of DC circuits.
23. * Demonstrate an understanding of the generation of magnetic fields by matter and the resulting interaction of magnetic fields and para-, dia- and ferro-magnetic materials.
24. * Demonstrate an understanding of the relationship between magnetic fields and moving charged particles.
25. * Demonstrate the ability to predict both the direction and magnitude of the magnetic fields near wires, coils, and solenoids using either the Biot-Savart Law or Ampere's Law.
26. * Demonstrate the ability to calculate magnetic flux and to use both Faraday's Law and Lenz's Law to predict the resulting EMF on an appropriate conducting element.
27. * Demonstrate the ability to use inductors, capacitors and resistors together in an electrical circuit and to calculate the resulting effects and interactions with AC electrical signals.

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- 28. * Demonstrate an understanding of nuclear physics, the resulting types of radioactive decay and the effects on living systems.
- 29. * Develop an understanding of the basic cosmological principles and their relationship to basic physical principles.
- 30. * Demonstrate an understanding of fluid statics and dynamics.
- 31. * Demonstrate a familiarity of Einstein's Special Theory of Relativity and its application to real world problems.
- 32. * Demonstrate an understanding of the Laws of Thermodynamics and their application to gases and heat engines.
- 33. * Demonstrate an understanding of kinetic theory and its relationship to temperature and heat.
- 34. Become familiar with recent developments in physics with a particular emphasis on those developments likely to have significant impact on society.
- 35. Develop an understanding of the importance of controlling multiple variables in experimental situations.
- 36. Demonstrate the ability to solve certain difficult physics problems through the development of appropriate computer programs and to use the computer in the laboratory as a tool for measurement and data analysis.
- 37. Demonstrate an understanding of the generation of error, its propagation through a series of manipulations and its effect on the significance of experimental results.
- 38. Develop an appreciation of the relationship between physics concepts and the corresponding mathematical concepts.
- 39. Demonstrate the ability to develop conceptual models to explain experimental results.

- 40. Demonstrate the ability to solve physics problems from a variety of reference frames.
- 41. Demonstrate the ability to use physics concepts in a wide variety of applications.
- 42. Demonstrate the ability to read appropriate scientific literature, organize the information contained therein and write a clear, concise synopsis.
- 43. Demonstrate the ability to write a well organized and clearly worded lab report.
- 44. Demonstrate knowledge and appreciation of the historical context of the major developments in physics.
- 45. Demonstrate the ability to use knowledge from other disciplines [i.e. calculus, statistics, computer programming, and electronics] to understand and solve problems in physics.
- 46. Demonstrate an awareness of physics related career opportunities.

The items marked with an asterisk (*) above are optional topics and will be covered as time, student ability and student interest permit. Some of these proficiencies will be covered during the Senior year program.

To measure mastery in accordance with the grading policy, attendance policy and other appropriate policies of the Board of Education, the teacher will select appropriate methods of evaluation as listed below:

- Student effort _____
- Performance relative to ability _____
- Classwork _____
- Homework _____
- Quizzes _____
- Unit tests _____

- Final and semester exams _____
- Term papers _____
- Book reports and outside reading _____
- Department exams _____
- Standardized tests _____
- Lab reports _____
- Class and lab participation _____

FREEHOLD REGIONAL COURSE PROFICIENCIES HIGH SCHOOL DISTRICT SCIENCE/ENGINEERING ADVANCED STUDY PHYSICS

Students enrolled in this course will demonstrate mastery of the following proficiency requirements as outlined in the curriculum guide and receive a passing grade in accordance with Board of Education policies on grading and attendance:

1. Demonstrate an understanding of electrostatics including the relationships among electric fields, forces and potentials.
2. Demonstrate the ability to use Gauss's Law in the determination of the electric fields near point sources, spheres, planes and cylinders for both conducting and insulating bodies.
3. Demonstrate the ability to determine the capacitance of capacitors of various designs including parallel plate, spherical shell and cylindrical shell with and without the presence of an insulating medium.
4. Demonstrate an understanding of the use and function of capacitors in series, parallel and in combined electrical circuits.
5. Demonstrate the ability to evaluate simple DC circuits through the use of

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- Ohm's Law Kirchoff's Laws and other applicable principles of DC circuits.
- Demonstrate an understanding of the generation of magnetic fields by matter and the resulting interaction of magnetic fields and para-, dia- and ferro- magnetic materials.
 - Demonstrate an understanding of the relationship between magnetic fields and moving charged particles.
 - Demonstrate the ability to predict both the direction and magnitude of the magnetic fields near wires, coils, and solenoids using either the Biot-Savart Law or Ampere's Law.
 - Demonstrate the ability to calculate magnetic flux and to use both Faraday's Law and Lenz's Law to predict the resulting EMF on an appropriate conducting element.
 - Demonstrate the ability to use inductors, capacitors and resistors together in an electrical circuit and to calculate the resulting effects and interactions with AC electrical signals.
 - * Demonstrate an understanding of nuclear physics, the resulting types of radioactive decay and the effects on living systems.
 - * Demonstrate an understanding of Einstein's Special Theory of Relativity and its application to real world problems.
 - * Demonstrate an understanding of the Laws of Thermodynamics and their application to gases and heat engines.
 - * Demonstrate an understanding of kinetic theory and its relationship to temperature and heat.
 - * Demonstrate the ability to apply kinetic and thermodynamic theory to the enthalpy and entropy of oxidation-reduction chemical reactions with specific emphasis on spontaneity, reaction rates and the effect of external stress on equilibrium systems.

The items marked with an asterisk (*) above are optional topics and will be

covered as time, student ability and student interest permit. Some of these proficiencies may have been covered in the Junior year program.

To measure mastery in accordance with the grading policy, attendance policy and other appropriate policies of the Board of Education, the teacher will select appropriate evaluative methods as listed below:

Student effort _____
 Performance relative to ability _____
 Classwork _____
 Homework _____
 Quizzes _____
 Unit tests _____
 Semester and final exams _____
 Term papers _____
 Book reports and outside reading _____
 Standardized tests _____
 Lab reports _____
 Class and lab participation _____

SCIENCE/ENGINEERING SENIOR PROJECT PHYSICS COURSE OUTLINE AND ASSIGNMENTS 2000-2001

CHAPTER 2: Speed, displacement, velocity, acceleration, graphing

READING TIPLER:
 2.1 Speed, displacement and velocity
 2.2 Instantaneous velocity
 2.3 Acceleration
 2.4 Constant acceleration
 2.5 Integration
 QUESTIONS TIPLER: 1,2,4,5,6,7,8,9,10
 CHAPTER 2 REVIEW P40: B & C
 PROBLEMS TIPLER P41+:
 LEVEL I: 1,3,5,6,7,8,9,10,11 Speed, displacement and velocity
 12,13,14,15 Instantaneous velocity

16,17,18 Acceleration
 19,21,22,23,24,25,26,27 Motion with constant acceleration
 28,29,30 Integration area under curve
 LEVEL II: 31,32,33,34,35,37,39,40,41, 42,43,44,45,47,49,50,52,53,54,55,57
 LEVEL III: 61,62,63,65,70,72,74,75
 LAB: #1 Measure the position, velocity and acceleration of a freefalling object.

TEST ON CHAPTER 2: ONE DIMENSIONAL MOTION

CHAPTER 3: Vectors, two and three dimensional motion, projectiles and centripetal acceleration.

READING TIPLER:

- Displacement vectors and vector addition
- Vector addition by components
- Vector properties
- Velocity vectors
- Acceleration vectors
- Relative velocities
- Projectile motion
- Circular motion and centripetal acceleration

QUESTIONS TIPLER:

1,2,3,4,5,7,9,10,11,12,13

REVIEW P71: B & C

PROBLEMS TIPLER P71+:

- LEVEL I: 1,3 Displacement vectors
 6 Vector components
 19,20,21 Velocity vectors
 22,23,24,25 Acceleration vectors
 26,27,28 Relative velocities
 29,30,31,33,34 Projectile motion
 35,36,39 Centripetal acceleration
 LEVEL II: 41,42,43,44,45,47,48,49, 50,51,53,55,57
 LEVEL III: 59,62,63,64,65, 69,70,71,72
 LABS: #2 Measure the range of a projectile as a function of the initial velocity.

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#3 Measure the centripetal acceleration of a rubber stopper.

TEST ON CHAPTER 3: TWO DIMENSIONAL MOTION

CHAPTER 4: Newton's Laws of Motion, mass, weight, force and momentum.

READING TIPLER:

- 4.1 Newton's First Law - Inertia
- 4.2 Newton's 2nd Law - Force & Mass
- 4.3 Force of Gravity - Weight
- 4.4 Newton's Third Law - Action Implies Reaction
- 4.5 Forces in Nature - Gravitation, electromagnetic, strong, & weak
- 4.6 Techniques in solving force problems.

QUESTIONS TIPLER:

1,2,3,4,5,6,7,8,9,10,11,14,15,16

REVIEW P101: B & D

PROBLEMS TIPLER P101+:

LEVEL I: 1,2,5,6,7,8,9,10,11,12,13 Force, Mass and the 2nd Law
14,15 Force of Gravity & Weight
20 Newton's Third Law
21,22,23,24,25,26,27,28,29 Problem Solving

LEVEL II: 30,31,32,33,34,35,

37,38,39,40,41,43

LEVEL III: 45,46,47,50,51

LABS: #4 Force vectors at equilibrium

#5 Verify Newton's Second Law of motion

CHAPTER 5: Friction, elastic forces, centripetal force, equilibrium and pseudo forces

READING TIPLER:

- 5.1 Force of Friction - Contact forces
- 5.2 Drag Forces
- 5.3 Problems with 2 or more Objects
- 5.4 Pseudoforces
- 5.5 Numerical Methods

QUESTIONS TIPLER: 1,2,3

REVIEW P128-129: B,C

PROBLEMS TIPLER P129+:

LEVEL I: 1,2,3,4,5,6,7 Force of Friction

9,11,12 Drag Forces

14,15,16,17 Problems with 2 or more Objects

19,21,23 Pseudoforces

LEVEL II: 25,26,27,28,29,30,31,32, 33,35,36,37,39,40,41,42,43,44,45,46

LEVEL III: 47,48,51,52,55,57,58,60

LABS: Measure the characteristics of the force of friction.

TEST ON CHAPTERS 4 AND 5: NEWTON'S LAWS OF MOTION

CHAPTER 6: Work, energy and power; energy conservation.

READING TIPLER:

6.1 Work in One Dimension with Constant Force

6.2 Work done by a Variable Force

6.3 Work and Energy in 3 Dimensions

6.4 Work and Potential Energy

6.5 Potential Energy and Equilibrium in one dimension

6.6 Conservation of Mechanical Energy

6.7 Work -Energy Theorem

6.8 Conservation of Energy

6.9 Power - the Rate of doing work.

QUESTIONS TIPLER:

1,2,3,4,5,6,7,9,10,11

REVIEW P173: B & C

PROBLEMS P174:

LEVEL I: 1,2,4 Work and Kinetic Energy - Constant Forces

5,6,7 Work Done by Variable Forces

8,9,10,14 Work in Three Dimensions

16,17,18,19,21,22 Work and Potential Energy

23,24,25,26 Potential Energy and Equilibrium

27,28,29,30,31,32,33 Conservation of Mechanical Energy

34,35,36,37,38 Work-Energy Theorem

39,40,41 Conservation of Energy

42,43,45,46,47 Power

LEVEL II: 49,50,51,53,54,55,57,58, 59,60,62,63,64,66,69,71,72,73,74

LEVEL III: 77,80,81,82,84,85,87

LABS:#8 Show that gravitational potential energy is conserved.

#9 Verify Hooke's Law and energy conservation

CHAPTER 10: Gravity, potential energy and escape velocity.

READING TIPLER:

10.1 Kepler's Laws

10.2 Newton's Law of Gravity

10.3 Universal Gravitational Constant

10.4 Gravitational and Inertial Mass

10.5 Escape Velocity

10.6 Potential Energy and Orbital Velocity

10.7 Calculating the Gravitational Field - Integration

ESSAY TIPLER P322+: Isaac Newton

REVIEW TIPLER P326: B & C

PROBLEMS P326+:

LEVEL I: 1,2,3,4,5,6,7 Kepler's Laws
8,9,10,11,12,13,14,15 Newton's Law of Gravity

17 Universal Gravitational Constant

19 Gravitational and Inertial Mass

20,21,22 Escape Velocity

23,24 Energy and Orbital Velocity

25,26 Gravitational Field

LEVEL II: 27,28,30,31,32,33,34,35, 36,37,38,41,44,45,46

LEVEL III: 48,49,54,55

TEST ON CHAPTERS 6/10: UNIVERSAL GRAVITATION

CHAPTER 7: Momentum and its conservation

READING TIPLER:

7.1 Center of Mass

7.2 Motion of the Center of Mass

7.3 Conservation of Momentum

7.4 Center-of-Mass Reference Frame

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7.5 Kinetic Energy of a System of Particles
7.6 Collisions in One Dimension
7.7 Collisions in Two and Three Dimensions
7.8 Impulse and Time Average of a Force
7.9 Jet Propulsion
QUESTIONS TIPLER:
1,3,4,6,7,8,9,10,11,13
ESSAY TIPLER P218+: Discovery of the Neutrino
REVIEW TIPLER P221: B/C
PROBLEMS P221+:
LEVEL I: 1,2,3,4,5,7 Center of Mass
8,9,10,11 Motion of the Center of Mass
13,14,15 Conservation of Momentum
17,18,19 Kinetic Energy of a System of Particles
21,22,23,26,27,28,29 Collisions in One Dimension
30,31,32 Collisions in Two and Three Dimensions
33,34,35,36 Impulse and Momentum
39,40,41 Jet Propulsion
LEVEL II: 42,43,45,46,47,48,49,50,52,53,54,55,56,57,58,59,60,61,64,65
LEVEL III: 69,71,77
LABS: #6 Verify the conservation of momentum in a closed system

TEST ON CHAPTER 7: MOMENTUM CONSERVATION

CHAPTER 8: Rotational kinematics, moment of inertia, and the application of the conservation laws to rotational systems.

READING TIPLER:
8.1 Angular Velocity and Acceleration
8.2 Torque and Moment of Inertia
8.3 Rotational Kinetic Energy
8.4 Calculating the Moment of Inertia
8.5 Angular Momentum
8.6 Rolling Objects
8.7 Vector Nature of Rotation and the Cross Product
8.8 Motion of a Gyroscope

8.9 Static and Dynamic Equilibrium
QUESTIONS TIPLER:
1,2,3,4,5,6,7,9,10,12,13
REVIEW TIPLER P265+: B/C
PROBLEMS TIPLER P266+:
LEVEL I: 1,2,3,4,6,7 Angular Velocity and Acceleration
9,10,11 Torque and Moment of Inertia
12,13,14,15 Rotational Kinetic Energy
17,19,21,22 Calculating the Moment of Inertia
23,24,25 Angular Momentum
28,29,30 Rolling Objects
33,37 Vectors and Cross Product
39,40 Motion of a Gyroscope
LEVEL II:
42,43,44,45,47,48,49,50,51,52,53,54,55,56,57,59,60,61,63,64,65,66,67,68,69,71,72,73,74
LEVEL III: 79,81,82,84,85,86,91,93
LABS: #11 Measure the angular displacement, velocity and acceleration of a rotating wheel under constant torque.

TEST ON CHAPTER 8: ROTATIONAL KINEMATICS

CHAPTER 9: Static Equilibrium of a Rigid Body

READING TIPLER:
9.1 Conditions for Equilibrium
9.2 Center of Gravity
9.3 Examples of Static Equilibrium
9.4 Couples - Opposite Forces NOT Acting Concurrently
9.5 Stability at Equilibrium
QUESTIONS TIPLER: 1,2,3,4,5,6,7,8
REVIEW TIPLER P288: B & C
PROBLEMS TIPLER P289+:
LEVEL I: 1,2,3,4,5,6,7 Conditions for Equilibrium
8,9,10,11 Center of Gravity
13,14,15,16 Examples of Static Equilibrium
17,19 Couples
LEVEL II: 20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40

LEVEL III: 43,44,45,47,49,50
LAB: #7 Measure opposing torques at equilibrium.

TEST ON CHAPTER 9: ROTATIONAL EQUILIBRIUM

CHAPTER 11: Mechanics of Solids/Fluids

READING TIPLER:
11.1 Density
11.2 Stress and Strain
11.3 Pressure in a Fluid
11.4 Buoyancy and Archimede's Principle
11.5 Surface Tension and Capillarity
11.6 Fluids in Motion; Bernoulli's Equation
11.7 Viscous Flow
QUESTIONS TIPLER: 1,2,44,5,7,8,9,10
ESSAY TIPLER P356: Aerodynamics of Bicycling
REVIEW TIPLER P360: B & C
PROBLEMS TIPLER P361+:
LEVEL I: 1,2,3,5,6 Density
7,8 Stress and Strain
11,12,13,14,15,17,18,19,20,21,22 Pressure in a Fluid
23,24,25,26 Buoyancy and Archimede's Principle
27,28 Surface Tension and Capillarity
29,30,31,32,33 Bernoulli's Equation
34,35,36 Viscous Flow
LEVEL II:
37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55
LEVEL III: 56,57,58,60,61
LABS: 1) Use Archimede's Principle to measure the density of a solid
2) Measure the surface tension of a fluid using capillary action.
3) Using a Manometer verify the Bernoulli Principle

TEST CH 11: MECHANICS OF FLUIDS AND SOLIDS

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CHAPTER 12: Simple harmonic motion, pendulums and oscillating systems.

READING TIPLER:

- 12.1 Simple harmonic motion [SHM] - Mass on a Spring
- 12.2 Rotation and SHM
- 12.3 Energy in SHM
- 12.4 SHM - Mass Oscillating on a Vertical Spring
- 12.5 Simple and Compound Pendulums
- 12.6 SHM near Equilibrium
- 12.7 Damped SHM
- 12.8 Driven SHM and Resonance
- QUESTIONS TIPLER: 1,2,3,4,5,6,7,8,9
- ESSAY TIPLER P397+: Chaos - An Orderly Disorder
- REVIEW TIPLER P403: B & C
- PROBLEMS P403+:
- LEVEL I: 1,3,4,5,6,7,8,9,10,11,13,15 SHM - Mass on a Spring
- 16,17 SHM and Rotational Motion
- 19,20,21,22 Energy in SHM
- 23,25 Object on a Vertical Spring
- 26,27,28,29,31,32,33 Simple and Compound Pendulums
- 34,35,37 Damped Oscillations
- 38,39,40 Forced Vibrations
- LEVEL II:
 - 41,42,43,44,45,46,47,48,49,50,51,53,55,56
- LEVEL III: 59,63,64,67
- LAB: #12 Measure the characteristics of a simple pendulum.

TEST ON CHAPTER 12: SIMPLE HARMONIC MOTION

CHAPTER 13: Waves, their characteristics and interactions.

READING TIPLER:

- 13.1 Wave Pulses and their Properties
- 13.2 Speed of Waves
- 13.3 Waves and SHM
- 13.4 Energy Transmitted by Waves

13.5 Superposition and Interference of Harmonic Waves

13.6 Standing Waves on a String

13.7 Superposition of Standing Waves

QUESTIONS TIPLER: 1,2,3,4

REVIEW TIPLER P433: B & C

PROBLEMS TIPLER P434+:

LEVEL I: 1,2,4,5,6 Wave pulses

9,10,11,12,13,15 Speed of waves

16,19,20,21 Harmonic waves

22,23,24 Energy Transmitted by Waves

25,27 Superposition and Interference of Harmonic Waves

28,29,30,31,32,33,34,35,36,38,39,40,41

Standing Waves

LEVEL II: 44,45,46,47,48,50,51,

54,55,57,58,59,61

LEVEL III: 64,66,67

LABS: #13A or #13B Measure wave characteristics on a string.

#14 Measure reflection, refraction, diffraction and interference in a ripple tank.

CHAPTER 14: Sound as a Wave Phenomenon

READING TIPLER:

- 14.1 Speed of Sound Waves
- 14.2 Harmonic Sound Waves
- 14.3 Sound Waves - Loudness and Intensity [Decibels]
- 14.4 Interference of Sound Waves - Beats
- 14.5 Standing Sound Waves
- 14.6 Harmonic Analysis and Synthesis
- 14.7 Dispersion of Sound Waves
- 14.8 Reflection, Refraction and Diffraction of Sound Waves
- 14.9 Doppler Effect

QUESTIONS TIPLER: 1,2,3,4,5,6

ESSAY TIPLER P472: Seismic Waves

REVIEW P477: B & C

PROBLEMS P 478+:

LEVEL I: 2,3,4,5 Speed of Sound Waves

7,9,10,11 Harmonic Sound Waves

13,14,15,16,17 Sound Intensity and

Decibels

18,19,21,22,23,26,27,28 Interference of Sound Waves - Beats

29,30,31,32,33 Standing Sound Waves

37,39,40,41,42,44,45,46 Doppler Effect

LEVEL II:

50,51,52,54,55,56,59,60,61,62,63,66,67,68,69,71,73,74,75,76

LEVEL III: 77,78,81,86,88

LAB: #15A or 15B Measure the speed, frequency and wavelength of a sound wave.

TEST ON CH 13 AND 14: WAVES AND SOUND

CHAPTER 30: Waves of Light

READING TIPLER:

- 30.1 Speed of Light
- 30.2 Huygen's Principle
- 30.3 Reflection of Light
- 30.4 Refraction of Light
- 30.5 Fermat's Principle
- 30.6 Polarization of Light
- 37.9 The LASER
- ESSAY TIPLER P1252--58: Trapped Atoms and Laser Cooling
- ESSAY TIPLER P1004-7: Beyond the Visible Rainbow
- REVIEW TIPLER P1008: B & C
- PROBLEMS TIPLER P1008+:
- LEVEL I: 1,2 Speed of Light
- 4,5 Reflection of Light
- 6,7,8,9,10,11,13,14 Refraction of Light
- 15 Fermat's Principle
- 17,18,19,20 Polarization of Light
- LEVEL II: 22,23,24,25,26,29,35,57,41,44
- LEVEL III: 50

CHAPTER 31: Geometric Optics

READING TIPLER:

- 31.3 Plane Mirrors
- 31.2 Spherical Mirrors - Ray Diagrams for Mirrors
- 31.3 Images Formed by Refraction

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31.4 Thin Lenses - Ray Diagrams for Lenses

31.5 Aberrations

QUESTIONS TIPLER: 1,3,5,6,7,8,9

REVIEW TIPLER P1036: B & C

PROBLEMS TIPLER P1037+:

LEVEL I: 1,3 Plane Mirrors

6,11,12,13 Spherical Mirrors

14,15,16,17,18,19,20,21 Images Formed by Refraction

22,23,24,25,26,27,29,31,33,34,35 Thin Lenses

37 Aberrations

LEVEL II: 39,41,43,44,47,49,51,53,55

LEVEL III: 57,59,61,65

LABS:#16 Verify the Laws of Reflection and determine the characteristics of images generated by plane, convex and concave mirrors.

#17 Measure the index of refraction of glass and trace the path of a light ray through a prism.

CHAPTER 32: Optical Instruments

READING TIPLER:

32.1 The Eye

32.2 The Simple Magnifier

32.3 The Camera

32.4 The Compound Microscope

32.5 The Telescope

QUESTIONS TIPLER: 1,2,3

REVIEW TIPLER P1058: B & C

PROBLEMS P1058+:

LEVEL I: 1,3,5,7,8 The Eye

9,11 Simple Magnifier

13,15,16,17 Camera

19,21 Compound Microscope

23,24,25 Telescope

LEVEL II: 29,31,33,35

LEVEL III: 36,37,39

TEST CHAPTERS 30,31 & 32: LIGHT OPTICS

CHAPTER 33: Interference and Diffraction of Light

READING TIPLER:

33.1 Phase Difference and Coherence

33.2 Interference of Thin Films

33.3 Michelson-Morley Interferometer

33.4 Two Slit Interference Pattern

33.5 Addition of Harmonic Waves Using Phasors

33.6 Interference of 3 or More Equally Spaced Sources

33.7 Diffraction Pattern of a Single Slit

33.8 Interference and Diffraction of a Double Slit

33.9 Fraunhofer [far] and Fresnel Diffraction [near]

33.10 Diffraction and the Limits of Resolution

22.11 Diffraction Gratings

QUESTIONS TIPLER: 1,2,3,4,6

REVIEW TIPLER P1093: B & C

PROBLEMS TIPLER P1092+:

LEVEL I: 1,2,3,4 Phase Difference and Coherence

5,6,7,8,9,10 Interference of Thin Films

11,12,13,15,16 Two Slit Interference Pattern

21 Interference of 3 or More Slits

23,24,25,26,27 Diffraction Pattern of a Single Slit

28,29 Double Slit Interference

31,32,33,35,36,37 Diffraction and Resolution

38,39,41 Diffraction Gratings

LEVEL II:

43,45,46,47,49,51,54,55,57,58,59

LEVEL III: 67

LABS: #23 Measure the wavelength of light.

#24 Determine the reflectance of light at an interface

#25 Measure and compare the diffraction effects of single and double slits.

#26 Measure the polarization of light through selective absorption.

#27 Use thin film interference to measure the thickness of a thin piece of cellophane.

#28 Verify Brewster's Law and polarization by scattering.

CHAPTER 35: The Origins of the Quantum Theory

READING TIPLER:

35.1 Blackbody Radiation

35.2 Photoelectric Effect

35.3 X-ray Production

35.4 Compton Scattering

35.5 Quantized Energy

35.6 Electron Waves and Quantum Theory

QUESTIONS TIPLER: 1,2,3

REVIEW TIPLER P1168: B & C

PROBLEMS TIPLER P1168+:

LEVEL I: 1,2,3,4,5,6,7,8,10,11 Photoelectric Effect

12,13,14 X-ray Production

15,16,17,19 Compton Scattering

21,22,23 Quantization of Energy

27,28,29,30,32,33,34,35,36,37,38 Electron Waves and Quantum Theory

LEVEL II: 39,41,42,43,45,46,47,48,49,50

LEVEL III: 58,59

CHAPTER 36: Quantum Mechanics

READING TIPLER:

36.1 Electron Wave Function

36.3 The Uncertainty Principle

36.4 Wave Particle Duality

36.6 A Particle in a Box

36.7 A Particle in a Finite Square Well

36.8 Expectation Values

36.9 Reflection and Transmission of Electron Waves

ESSAY TIPLER P1209-12: Scanning Tunneling Microscopy

QUESTIONS TIPLER: 1,3,4

REVIEW TIPLER P1213: B & C

PROBLEMS TIPLER P1214+:

LEVEL I: 7,9 Uncertainty Principle

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12,13,14,15 Wave-Particle Duality

TEST ON CHAPTERS 33,35 & 36 : LIGHT WAVES AND WAVE PARTICLE DUALITY

CHAPTER 34: Special and General Relativity

READING TIPLER:

- 34.1 Newtonian Relativity
- 34.2 Michelson Morley Interferometer
- 34.3 Einstein's Postulates
- 34.4 The Lorentz Transformation
- 34.5 Clocks and Simultaneity
- 34.6 Relativity and the Doppler Effect
- 34.7 The Twin Paradox
- 34.8 The Velocity Transformation
- 34.9 Relativistic Momentum
- 34.10 Relativistic Energy
- 34.11 General Relativity

QUESTIONS TIPLER: 1,2,3,4

REVIEW TIPLER P1138-9: B & C

PROBLEMS TIPLER P1139:

- LEVEL I: 1 Michelson-Morley
- 3,4,5,7,8,9,10,11,12,13,15,16 Lorentz Transformations
- 17,18,19,20,21 Simultaneity
- 22,25,27 Doppler Effect
- 28 Twin Paradox
- 29,31 Velocity Transformations
- 33,35,37,38,39,41,42,43,44,45,46 Relativistic Energy
- LEVEL II:
47,49,51,52,53,55,57,58,59,61,62,63,67,68,71,75

TEST ON CHAPTER 34: SPECIAL RELATIVITY

CHAPTER 27: Magnetism in Matter

READING TIPLER:

- 27.1 Magnetization and Magnetic Susceptibility
- 27.2 Atomic Magnetic Moments
- 27.3 Paramagnetism
- 27.4 Ferromagnetism

27.5 Diamagnetism

QUESTIONS TIPLER: 1,2,3,4,5,6,7

ESSAY TIPLER P1322-1325: SQUID -
Superconducting Quantum Interference
Device

REVIEW TIPLER P894-5: B & C

PROBLEMS TIPLER P895+:

- LEVEL I: 1,2,5,7 Magnetization and Susceptibility
- 12,13,15 Ferromagnetism
- LEVEL II: 17,23

CHAPTER 24: Magnet Fields

READING TIPLER:

- 24.1 Force Exerted on a Moving Charge by a Magnetic Field
- 24.2 Motion of a Point Charge in a Magnetic Field
- 24.3 Torques on Current Loops Sitting in Magnetic Fields
- 24.4 Hall Effect
- 37.4 The Stern-Gerlach Experiment - Electron Spin

QUESTIONS TIPLER: 1,2,3,4,6,7,8,9,10

REVIEW TIPLER P806: B & C

PROBLEMS TIPLER P806+:

- LEVEL I: 1,2,3,5,7 Force Exerted by a Magnetic Field
- 8,9,10,11,12,13,14,15 Motion of a Point Charge in a Magnetic Field
- 17,18,19,21,23 Torques on Current Loops
- 25,26,27,28 Hall Effect
- LEVEL II: 30,31,32,33,35,43,47,49,50,51
- LEVEL III: 52,53,57,59

LABS: #24 Measure the strength of a magnetic field using the Hall Effect.

#25 Measure the magnetic force acting on a moving charged particle.

#26 Measure the magnetic force acting on a current carrying wire.

CHAPTER 25: Sources of Magnetic Fields

READING TIPLER:

- 25.1 Magnetic Fields of Moving Point Charges

25.2 Magnetic Fields of Currents - Biot Savart Law

25.3 Definition of the Ampere

25.4 Ampere's Law

REVIEW TIPLER P834: B & C

PROBLEMS TIPLER P834+:

- LEVEL I: 1,3,5 Magnetic Fields of Moving Point Charges
- 6,7,9,11,12,14,15,17,19,21,22,23,24 Biot Savart Law
- 25,26,27,29 Definition of the Ampere
- 30,31,32,33,35 Ampere's Law
- LEVEL II: 36,37,38,40,41,42,43,45,47,49,51,53,54,55,56
- LEVEL III: 59,61

LABS: #27 Measure the magnetic field strength near a current carrying wire.

#28 Measure the magnetic force between two parallel current carrying wires.

TEST ON CHAPTERS 27, 24 & 25: MAGNETIC EFFECTS

CHAPTER 26: Magnetic Induction

READING TIPLER:

- 26.1 Magnetic Flux
- 26.2 Induced EMF and Faraday's Law
- 26.3 Lenz's Law
- 26.4 Motional EMF
- 26.5 Eddy Currents
- 26.6 Generators and Motors
- 26.7 Self and Mutual Inductance
- 26.8 LR Circuits
- 26.9 Magnetic Energy

QUESTIONS TIPLER: 1,2,3,4,5,6,7

ESSAY TIPLER P866: The Aurora

REVIEW TIPLER P871: B & C

PROBLEMS TIPLER P871+:

- LEVEL I: 1,2,3,5,6,7 Magnetic Flux
- 8,9,10,11,12,13,15,17 Induced EMF and Faraday's Law
- 18,19,20,21 Lenz's Law
- 22,23,24,25 Motional EMF
- 26,27,28,29 Generators and Motors
- 30,32,33 Inductance
- 34,35,36,37 LC Circuits

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38,39,40,41 Magnetic Energy

LEVEL II: 42,47,48,49,51,52,53,54,
56,57,58,59,60,61,64,65,67,68

LEVEL III: 72,76,79

LAB: Measure the self inductance of an
induction coil.

CHAPTER 28: Alternating Current Circuits

READING TIPLER:

28.1 Alternating Current in a Resistor

28.2 Alternating Current in Inductors and
Capacitors

28.3 Phasor Diagrams

28.4 LC and LCR Circuits [resonance]

28.5 LCR Circuits with a Generator

28.6 Transformers

28.7 Rectification and Amplification

ESSAY TIPLER P929-36: Electric Motors

QUESTIONS TIPLER: 1,2,3,4,5,6,7,8

REVIEW TIPLER P937: B & C

PROBLEMS TIPLER P937+:

LEVEL I: 1,2,3 Alternating Current in a
Resistor

5,7,9,13 Alternating Current in Inductors
and Capacitors

16,17,18,19 LC and LCR Circuits

20,21,23,25,27,28 LCR Circuits with a
Generator 29,30,31 Transformers

LEVEL II: 35,37,39,40,41,43,45,47,
49,53,54,55,56,57,58,62,63,65

LAB: Measure the impedance of an AC
circuit.

CHAPTER 29: Maxwell's Equations and Electromagnetic Waves

READING TIPLER: [Read for qualitative
content ONLY!]

29.1 Maxwell's Displacement Current

29.2 Maxwell's Equations

29.4 Energy and Momentum in Magnetic
Waves

29.5 Electromagnetic Spectrum

QUESTIONS TIPLER: 1,2,3

ESSAY TIPLER P964-967: James Clerk
Maxwell

REVIEW TIPLER P968: B & C

TEST ON CHAPTERS 26, 28 & 29: MAGNETIC INDUCTION

CHAPTER 18: Electric Fields Caused by Discrete Charges

READING TIPLER:

18.1 Electric Charge

18.2 Conductors and Insulators, Charging
by Induction

18.3 Coulomb's Law

38.1 Molecular Bonding

18.4 Electric Fields

18.5 Electric Field Lines

18.6 Motion of Point Charges in Uniform
Electric Fields

18.7 Electric Dipoles in Uniform Electric
Fields

QUESTIONS TIPLER: 1,2,4,5

REVIEW TIPLER P619-20: B & C

PROBLEMS P620+:

LEVEL I: 1,3 Electric Charge

4,5 Conductors, Insulators and Induction
6,7,8,9,10 Coulomb's Law

11,12,13,15 Electric Fields

17,18,19,20 Electric Field Lines

21,23,24 Motion of Point Charges in a
Uniform Electric Field

25,26 Electric Dipoles in Electric Fields

LEVEL II:

27,28,29,30,32,33,35,37,39,40,41

LEVEL III: 44,45,47

CHAPTER 19: The Electric Field of a Continuous Charge Distribution

READING TIPLER:

19.1 Calculating the Electric Field of
Continuous Charge Distributions

19.2 Gauss's Law [Exceptionally
important!]

19.3 Calculating Electric Fields Using
Gauss's Law

19.4 Charge and the Electric Field at the
Surface of a Conductor

QUESTIONS TIPLER: 1,2,3,4,5,6

REVIEW P651-2: B & C

PROBLEMS TIPLER P652+:

LEVEL I: 1,2,3,4,5,6,8,9 Electric Field
from Coulomb's law

10,11,12,13,15 Gauss's Law

17,18,19,20,21,22 Calculating Electric
Field from Gauss's Law

24,25,26,27 Charge and Electric Fields
near a Conductor's Surface

LEVEL II:

28,30,31,32,35,36,38,39,40,41,45,46

LEVEL III: 47,48,49,50,51

TEST CHAPTERS 18 & 19: ELECTRIC FIELDS AND FORCES

CHAPTER 20: Electrostatic Potential

READING TIPLER:

20.1 Electric Potential and Potential
Difference

20.2 Potential due to a System of Point
Charges

20.3 Electrostatic Potential Energy

20.4 Calculating Electrostatic Potential of
Continuous Charges

20.5 Electric Fields and Electrostatic
Potential

20.6 Equipotential Surfaces and Dielectric
Breakdown

QUESTIONS TIPLER: 1,2,3,4,5,6,7

ESSAY TIPLER P682: Electrostatics and
Xerography

REVIEW P685: B & C

PROBLEMS TIPLER P685:

LEVEL I: 1,2,3,4,5 Electric Potential and
Potential Difference

6,7,8,9 Potential Due to a System of Point
Charges

10,11,13 Electrostatic Potential Energy

14,15,16,17 Electrostatic Potential of
Continuous Charges

18,19,20,21,23 Relationship between
Electric Fields and Potential

25,28 Equipotential Surfaces and
Dielectric Breakdown

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LEVEL II:

29,30,31,32,33,34,35,37,38,39,40,41,42,43,44,45,47,48,49,51,53

LEVEL III: 57,59,63,64

LAB: #23 Measure the electrostatic force acting on a charged particle.

CHAPTER 21: Capacitance, Dielectrics, and Electrostatic Energy

READING TIPLER:

21.1 Parallel-Plate Capacitors

21.2 Cylindrical Capacitors

21.3 Dielectrics

21.4 Storage of Electrical Energy

21.5 Combinations of Capacitors

QUESTIONS TIPLER: 1,2

REVIEW TIPLER P710: B & C

PROBLEMS TIPLER P710+:

LEVEL I: 1,2,3,4 Parallel Plate Capacitors

5,6 Cylindrical Capacitors

7,8,9 Dielectrics

10,11,12,13,15 Storage of Electrical Energy

16,17,18,19,20,21,22,23 Combinations of Capacitors

LEVEL II:

24,25,26,27,28,29,31,33,34,35,36,37,38,39,41,42,43,45,46,47,48,50,51,52,53,55,56,58

LEVEL III: 59,60,61,63,65,67

LAB: #21 Measure the Capacitance of a Parallel Plate Capacitor.

TEST ON CHAPTERS 20 & 21: POTENTIAL AND CAPACITANCE

CHAPTER 22: DC Electric Currents

READING TIPLER:

22.1 Current and the Motion of Charge

22.2 Resistance and Ohm's Law

22.3 Energy in Electric Circuits

22.4 Combinations of Resistors

22.5 Drift Velocity and Current

QUESTIONS TIPLER: 1,2,3,4,6,7,8

ESSAY TIPLER P740: Conduction in Nerve Cells

REVIEW TIPLER P744: B & C

PROBLEMS TIPLER P745+:

LEVEL I: 1,2,3,6,7,8 Current and Motion of Charges

9,10,11,13,15,16,18 Resistance and Ohm's Law

19,20,21,22,23,24,25,26,27,28,29 Energy in Electric Circuits

30,31,32,33,34,35,36,37 Resistors in Series and Parallel

LEVEL II:

38,40,42,43,44,45,46,47,50,51,52,53,55,58,59,60,61

LEVEL III: 62,64,66,67,68

CHAPTER 23: Direct Current Circuits

READING TIPLER:

23.1 Kirchoff's Rules

23.2 RC Circuits

23.3 Ammeters, Voltmeters and Ohmmeters

39.5 Semi-conductors and Band Theory

39.6 Impurity Semi-conductors

39.7 Semi-conductor Junctions and Devices

39.8 Superconductivity

QUESTIONS TIPLER: 1,2,3,4

REVIEW TIPLER P773: B & C

PROBLEMS TIPLER P773+:

LEVEL I: 1,3,4,5,6,7,8 Kirchoff's Rules

9,11,12,13 RC Circuits

15,17,18,19,21,22

LEVEL II:

24,25,26,28,29,30,31,32,33,35,36,37,38,39,40,41,42,43

LEVEL III: 47,50,60,61,62,63,64,65

LABS: #22 Measure various characteristics of DC electrical circuits.

TEST ON CHAPTERS 22 & 23: DC CIRCUITS

CHAPTER 18: Electric Fields Caused by Discrete Charges

READING TIPLER:

18.1 Electric Charge

18.2 Conductors and Insulators, Charging by Induction

18.3 Coulomb's Law

38.1 Molecular Bonding

18.4 Electric Fields

18.5 Electric Field Lines

18.6 Motion of Point Charges in Uniform Electric Fields

18.7 Electric Dipoles in Uniform Electric Fields

QUESTIONS TIPLER: 1,2,4,5

REVIEW TIPLER P619-20: B & C

PROBLEMS P620+:

LEVEL I: 1,3 Electric Charge

4,5 Conductors, Insulators and Induction

6,7,8,9,10 Coulomb's Law

11,12,13,15 Electric Fields

17,18,19,20 Electric Field Lines

21,23,24 Motion of Point Charges in a Uniform Electric Field

25,26 Electric Dipoles in Electric Fields

LEVEL II: 27,28,29,30,32,33,35,37,39,40,41

LEVEL III: 44,45,47

CHAPTER 19: The Electric Field of a Continuous Charge Distribution

READING TIPLER:

19.1 Calculating the Electric Field of Continuous Charge Distributions

19.2 Gauss's Law [Exceptionally important!]

19.3 Calculating Electric Fields Using Gauss's Law

19.4 Charge and the Electric Field at the Surface of a Conductor

QUESTIONS TIPLER: 1,2,3,4,5,6

REVIEW P651-2: B & C

PROBLEMS TIPLER P652+:

LEVEL I: 1,2,3,4,5,6,8,9 Electric Field from Coulomb's law

10,11,12,13,15 Gauss's Law

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17,18,19,20,21,22 Calculating Electric Field from Gauss's Law

24,25,26,27 Charge and Electric Fields near a Conductor's Surface

LEVEL II:

28,30,31,32,35,36,38,39,40,41,45,46

LEVEL III: 47,48,49,50,51

TEST CHAPTERS 18 & 19: ELECTRIC FIELDS AND FORCES

CHAPTER 20: Electrostatic Potential

READING TIPLER:

20.1 Electric Potential and Potential Difference

20.2 Potential due to a System of Point Charges

20.3 Electrostatic Potential Energy

20.4 Calculating Electrostatic Potential of Continuous Charges

20.5 Electric Fields and Electrostatic Potential

20.6 Equipotential Surfaces and Dielectric Breakdown

QUESTIONS TIPLER: 1,2,3,4,5,6,7

ESSAY TIPLER P682: Electrostatics and Xerography

REVIEW P685: B & C

PROBLEMS TIPLER P685:

LEVEL I: 1,2,3,4,5 Electric Potential and Potential Difference

6,7,8,9 Potential Due to a System of Point Charges

10,11,13 Electrostatic Potential Energy

14,15,16,17 Electrostatic Potential of Continuous Charges

18,19,20,21,23 Relationship between Electric Fields and Potential

25,28 Equipotential Surfaces and Dielectric Breakdown

LEVEL II:

29,30,31,32,33,34,35,37,38,39,40,41,42,43,44,45,47,48,49,51,53

LEVEL III: 57,59,63,64

LAB: #23 Measure the electrostatic force acting on a charged particle.

CHAPTER 21: Capacitance, Dielectrics, and Electrostatic Energy

READING TIPLER:

21.1 Parallel-Plate Capacitors

21.2 Cylindrical Capacitors

21.3 Dielectrics

21.4 Storage of Electrical Energy

21.5 Combinations of Capacitors

QUESTIONS TIPLER: 1,2

REVIEW TIPLER P710: B & C

PROBLEMS TIPLER P710+:

LEVEL I: 1,2,3,4 Parallel Plate Capacitors

5,6 Cylindrical Capacitors

7,8,9 Dielectrics

10,11,12,13,15 Storage of Electrical Energy

16,17,18,19,20,21,22,23 Combinations of Capacitors

LEVEL II:

24,25,26,27,28,29,31,33,34,35,36,37,38,39,41,42,43,45

46,47,48,50,51,52,53,55,56,58

LEVEL III: 59,60,61,63,65,67

LAB: #21 Measure the Capacitance of a Parallel Plate Capacitor.

TEST ON CHAPTERS 20 & 21: POTENTIAL AND CAPACITANCE

CHAPTER 40: Nucleii and Nuclear Energy

READING TIPLER:

40.1 Properties of Nucleii

40.2 Nuclear Magnetic Resonance

40.3 Radioactivity

40.4 Nuclear Reactions

40.5 Fission, Fusion and Nuclear Reactors

40.6 Interaction of Particles with Matter

QUESTIONS TIPLER:

1,2,3,4,6,7,8,9,11,12,13,14,15,16,17

REVIEW TIPLER P1363: B & C

PROBLEMS TIPLER:

LEVEL I: 1,2,4,5 Properties of Nucleii

9,10,11,12,13,14,15,16,17,18,19,20

Radioactivity

21 Nuclear Reactions

23,24,25 Fission, Fusion and Nuclear Reactors

26,27,28 Particles and Matter

LEVEL II:

35,37,38,39,40,41,45,46,47,48,49,50,51,52

LEVEL III: 53,55,58,59,61

LABS:

#31 Measure the relative penetrating abilities of alpha, beta and gamma radiations.

#32 Measure the radioactive half life of a short lived isotope.

CHAPTER 41: Elementary Particles

READING TIPLER:

41.1 Hadrons and Leptons

41.2 Spin and Antiparticles

41.3 The Conservation Laws

41.4 The Quark Model

41.5 Field Particles

41.6 The Electro-weak Theory

41.7 The Standard Model

41.8 Grand Unification Theories

REVIEW TIPLER P1386: B & C

PROBLEMS TIPLER P1387:

LEVEL I: 2,3 Spin and Anti-particles

4,5,6,7,8 The Conservation Laws

9,13 The Quark Model

15 Field Particles

LEVEL II: 18,19,20,21,24,25

LEVEL III: 26,27

TEST ON CHAPTERS 40 & 41: ELEMENTARY PARTICLES AND RADIOACTIVE DECAY

CHAPTER 15: Temperature and the Kinetic Theory of Gases

READING TIPLER:

15.1 Celsius and Fahrenheit Temperature Scales

15.2 Gas Thermometers and Absolute Temperature

15.3 Thermal Expansion

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15.4 Ideal Gas Law
15.5 Kinetic Theory of Gases
15.6 Special cases - Liquid Vapor Systems
15.7 Phase Diagrams
QUESTIONS TIPLER: 1,2,3,5,6,7,8,9,
10,11,12,13,14,15,16
REVIEW TIPLER P513: B & C
PROBLEMS P513+:
LEVEL I: 1,3,5 Celsius and Fahrenheit
7,9 Absolute Temperature - Kelvin
11,12,13 Thermal Expansion - Linear
14,15,17,19 Ideal Gas Law 20,21,22,23
Kinetic Theory of Gases
27,29 Vapor Pressure
LEVEL II: 30,31,32,33,35,36,38,41,
43,45,46,47,49
LEVEL III: 56,57,58,60,61
LAB: Verify the Ideal Gas Law.

CHAPTER 16: Heat and the First Law of Thermodynamics

READING TIPLER:
16.1 Specific Heat and Heat Capacity
16.2 Change of Phase and Latent Heat
16.3 Transfer of Thermal Energy -
Conduction, Convection and Radiation
16.4 First Law of Thermodynamics - $Q = DU + W$
16.5 Internal Energy of an Ideal Gas
16.6 Work done by an Expanding Gas
16.7 Heat Capacity and Equipartition of
Energy
16.8 Quasi-Static Adiabatic Expansion of
a Gas
QUESTIONS TIPLER: 1,2,3,4,5,6,7,8
ESSAY TIPLER P553+: Global Warming
REVIEW TIPLER P557-8: B & C
PROBLEMS P558+:
LEVEL I: 1,2,3,4 Heat Capacity and
Specific Heat
5,6,7 Change of Phase and Latent Heat
8,9,10,11,12 Transfer of Thermal Energy
14,15,16,17 First Law of Thermodynamics
19,20,21,22,23,24 Work done by an
Expanding Gas
25,27 Equipartition Theorem

29,30 Adiabatic Expansion of a Gas
LEVEL II: 31,33,37,38,39,41,42,
43,45,47,49,51,53,55
LEVEL III: 59,61,63,64,65

CHAPTER 17: The Conversion of Heat into Useful Work

READING TIPLER:
17.1 Heat Engines and the Second Law of
Thermodynamics
17.2 Refrigerators and the Second Law of
Thermodynamics
17.3 Equivalence of Refrigerators and
Heat Engines
17.4 The Carnot Cycle Engine
17.5 The Heat Pump - Moving Heat from
Place to Place
17.6 Entropy and Disorder
17.7 Entropy and Probability
QUESTIONS TIPLER: 1,2,3,4,5
ESSAY P586: Exponential Growth and
Decay
REVIEW P590-91: B & C
PROBLEMS P591+:
LEVEL I: 1,2,3 Heat Engines
5 Refrigerators
6,7 Equivalence of Heat Engines and
Refrigerators
9,10,11,12,13,15,16 Carnot Cycle Engine
17,19 Heat Pumps
21,23,25,27,29 Entropy and Disorder
LEVEL II: 31,32,33,35,36,37,39,
41,43,44,45,47
LEVEL III: 50,51,52,55,57,58

TEST ON CHAPTERS 15-17: HEAT AND THERMODYNAMICS

CHAPTER 42: Astrophysics and Cosmology

READING TIPLER:
42.1 Our Star, the Sun
42.2 The Stars
42.3 The Evolution of Stars
42.4 Cataclysmic Events
42.5 The Final States of Stars [Black
Holes]

42.6 Galaxies [Hubble's Law]
42.7 Gravitation and Cosmology
42.8 Cosmogogenesis
REVIEW TIPLER P1422-3: B & C
PROBLEMS TIPLER P1423:
LEVEL I: 1 The Sun 2,3 The Stars
5,6 Evolution of Stars
9 Cataclysmic Events
10,11,12 Final States of Stars [Black
Holes] 13 Galaxies
LEVEL II: 21,22,23
LEVEL III: 26

TEST ON CHAPTER 42: COSMOLOGY

MANY OF THESE
ASSIGNMENTS WILL
ALSO BE SUPPLEMENTED
BY HANDOUT PROBLEMS
INTENDED TO EASE THE
TRANSITION FROM THE
THEORY TO THE MORE
DIFFICULT PROBLEMS
FREQUENTLY
PRESENTED IN THE TEXT!