

PIRA Demonstration Classification Scheme

MECHANICS

1A Measurements

10. Basic Units
20. Error and Accuracy
30. Coordinate Systems
40. Vectors
50. Math Topics
60. Scaling

1C Motion in One Dimension

10. Velocity
20. Uniform Acceleration
30. Measuring g

1D Motion In Two Dimensions

10. Displacement in Two Dimensions
15. Velocity, Position, and Acceleration
40. Motion of the Center of Mass
50. Central Forces
52. Deformation by Central Forces
55. Centrifugal Escape
60. Projectile Motion

1E Relative Motion

10. Moving Reference Frames
20. Rotating Reference Frames
30. Coriolis Effect

1F Newton's First Law

10. Measuring Inertia
20. Inertia of Rest
30. Inertia of Motion

1G Newton's Second Law

10. Force, Mass, and Acceleration
20. Accelerated Reference Frames
30. Complex Systems

1H Newton's Third Law

10. Action and Reaction
11. Recoil

1J Statics of Rigid Bodies

10. Finding Center of Gravity
11. Exceeding Center of Gravity
20. Stable, Unstable, and Neutral Equilibrium
30. Resolution of Forces
40. Static Torque

1K Applications of Newton's Laws

10. Dynamic Torque
20. Friction
30. Pressure

1L Gravity

10. Universal Gravitational Constant
20. Orbits

1M Work and Energy

10. Work
20. Simple Machines
30. Non-Conservative Forces
40. Conservation of Energy
50. Mechanical Power

1N Linear Momentum and Collisions

10. Impulse and Thrust
20. Conservation of Linear Momentum
21. Mass and Momentum Transfer
22. Rockets
30. Collisions in One Dimension
40. Collisions in Two Dimensions

1Q Rotational Dynamics

10. Moment of Inertia
20. Rotational Energy
30. Transfer of Angular Momentum
40. Conservation of Angular Momentum
50. Gyros
60. Rotational Stability

1R Properties of Matter

10. Hooke's Law
20. Tensile and Compressive Stress
30. Shear Stress
40. Coefficient of Restitution
50. Crystal Structure

FLUID MECHANICS

2A Surface Tension

10. Force of Surface Tension
15. Minimal Surface
20. Capillary Action
30. Surface Tension Propulsion

2B Statics of Fluids

20. Static Pressure
30. Atmospheric Pressure
35. Measuring Pressure
40. Density and Buoyancy
60. Siphons, Fountains, Pumps

2C Dynamics of Fluids

10. Flow Rate
20. Forces in Moving Fluids
30. Viscosity
40. Turbulent and Streamline Flow
50. Vortices
60. Non-Newtonian Fluids

OSCILLATIONS AND WAVES

3A Oscillations

10. Pendula
15. Physical Pendula
20. Springs and Oscillators
40. Simple Harmonic Motion
50. Damped Oscillators
60. Driven Mechanical Resonance
70. Coupled Oscillations
75. Normal Modes
80. Lissajous Figures
95. Non-Linear Systems

3B Wave Motion

10. Transverse Pulses and Wave
20. Longitudinal Pulses and Waves
22. Standing Waves
25. Impedance and Dispersion
27. Compound Waves

OSCILLATIONS AND WAVES (cont.)

30. Wave Properties of Sound
33. Phase and Group Velocity
35. Reflection and Refraction (Sound)
39. Transfer of Energy in Waves
40. Doppler Effect
45. Shock Waves
50. Interference and Diffraction
55. Interference and Diffraction of Sound
60. Beats
70. Coupled Resonators

3C Acoustics

10. The Ear
20. Pitch
30. Intensity and Attenuation
40. Architectural Acoustics
50. Wave Analysis and Synthesis
55. Music Perception and the Voice

3D Instruments

20. Resonance in Strings
22. Stringed Instruments
30. Resonance Cavities
32. Air Column Instruments
40. Resonance in Plates, Bars, Solids
42. Percussion Instruments
46. Tuning Forks
50. Electronic Instruments

3E Sound Reproduction

20. Loudspeakers
30. Microphones
40. Amplifiers
60. Recorders

THERMODYNAMICS

4A Thermal Properties of Matter

10. Thermometry
20. Liquid Expansion
30. Solid Expansion
40. Properties of Materials at Low Temperatures
50. Liquid Helium

4B Heat and the First Law

10. Heat Capacity and Specific Heat
20. Convection
30. Conduction
40. Radiation
50. Heat Transfer Applications
60. Mechanical Equivalent of Heat
70. Adiabatic Processes

4C Change of State

10. PVT Surfaces
20. Phase Changes: Liquid-Solid
30. Phase Changes: Liquid-Gas
31. Cooling by Evaporation
32. Dew Point and Humidity
33. Vapor Pressure
40. Sublimation
45. Phase Changes: Solid-Solid
50. Critical Point

4D Kinetic Theory

10. Brownian Motion
20. Mean Free Path
30. Kinetic Motion
40. Molecular Dimensions
50. Diffusion and Osmosis

4E Gas Law

10. Constant Pressure
20. Constant Temperature
30. Constant Volume

4F Entropy and the Second Law

10. Entropy
30. Heat Cycles

ELECTRICITY AND MAGNETISM

5A Electrostatics

10. Producing Static Charge
20. Coulomb's Law
22. Electrostatic Meters
30. Conductors and Insulators
40. Induced Charge
50. Electrostatic Machines

5B Electric Fields and Potential

10. Electric Field
20. Gauss' Law
30. Electrostatic Potential

5C Capacitance

10. Capacitors
20. Dielectric
30. Energy Stored in a Capacitor

5D Resistance

10. Resistance Characteristics
20. Resistivity and Temperature
30. Conduction in Solutions
40. Conduction in Gases

5E Electromotive Force and Current

20. Electrolysis
30. Plating
40. Cells and Batteries
50. Thermoelectricity
60. Piezoelectricity

5F DC Circuits

10. Ohm's Law
15. Power and Energy
20. Circuit Analysis
30. RC Circuits
40. Instruments

5G Magnetic Materials

10. Magnets
20. Magnetic Domains and Magnetization
30. Paramagnetism and Diamagnetism
40. Hysteresis
45. Magnetostriction and Magnetoresistance
50. Temperature and Magnetism

ELECTRICITY AND MAGNETISM (cont.)

5H Magnetic Fields and Forces

10. Magnetic Fields
15. Fields and Currents
20. Forces on Magnets
25. Magnet/Electromagnet Interaction
30. Force on Moving Charges
40. Force on Current in Wires
50. Torques on Coils

5J Inductance

10. Self Inductance
20. LR Circuits
30. RLC Circuits - DC

5K Electromagnetic Induction

10. Induced Currents and Forces
20. Eddy Currents
30. Transformers
40. Motors and Generators

5L AC Circuits

10. Impedance
20. RLC Circuits - AC
30. Filters and Rectifiers

5M Semiconductors and Tubes

10. Semiconductors
20. Tubes

5N Electromagnetic Radiation

10. Transmission Lines and Antennas
20. Tesla Coil
30. Electromagnetic Spectrum

OPTICS

6A Geometrical Optics

01. Speed of Light
02. Straight Line Propagation
10. Reflection from Flat Surfaces
20. Reflection from Curved Surfaces
40. Refractive Index
42. Refraction from Flat Surfaces
44. Total Internal Reflection
46. Rainbow
60. Thin Lens
61. Pinhole
65. Thick Lens
70. Optical Instruments

6B Photometry

10. Luminosity
30. Radiation Pressure
40. Blackbodies

6C Diffraction

10. Diffraction through One Slit
20. Diffraction Around Objects

6D Interference

10. Interference from Two Sources
15. Interference of Polarized Light
20. Gratings
30. Thin Films
40. Interferometers

6F Color

10. Synthesis and Analysis of Color
30. Dispersion
40. Scattering

6H Polarization

10. Dichroic Polarization
20. Polarization by Reflection
30. Circular Polarization
35. Birefringence
50. Polarization by Scattering

6J The Eye

10. The Eye
11. Physiology

6Q Modern Optics

10. Holography
20. Physical Optics

MODERN PHYSICS

7A Quantum Effects

10. Photoelectric Effect
15. Millikan Oil Drop
20. Compton Effect
50. Wave Mechanics
55. Particle/Wave Duality
60. X-ray and Electron Diffraction
70. Condensed Matter

7B Atomic Physics

10. Spectra
11. Absorption
13. Resonance Radiation
20. Fine Splitting
30. Ionization Potential
35. Electron Properties
50. Atomic Models

7D Nuclear Physics

10. Radioactivity
20. Nuclear Reactions
30. Particle Detectors
40. NMR
50. Models of the Nucleus

7E Elementary Particles

10. Miscellaneous

7F Relativity

10. Special Relativity
20. General Relativity

ASTRONOMY

8A Planetary Astronomy

10. Solar System Mechanics
20. Planetary Geology

8B Stellar Astronomy

10. Miscellaneous

8C Cosmology

10. Models of the Universe
20. Black Holes