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