Feynman Simplified Index

	MAIN TOPIC	SUB TOPIC	<u>eBook</u>	Ch	Section
*	denotes Section or Chapter Title				
	A				
*	Aberration of Starlight	due to observer's motion	1C	37	37.9
	Absolute Zero		1A	1	1.9
	Absorption Index		1C	34	34.3
	Acceleration	Definition	1A	6	6.6
	Acceleration	Definition	1A	7	7.2
	Action of Motion	S = Kinetic Energy – Potential Energy	2D	36	36.1
*	Action, Generalized		2D	36	36.7
	Activation Energy		1B	18	18.4
	Active Circuit Elements		2B	22	22.1
*	Adding Velocities Relativistically		1C	25	25.7
*	Adding Waves Mathematically		1D	43	43.2
	Adiabatic	Change without Heat Flow	1B	15	15.2
	Adiabatic	Expansion & Compression	1B	21	21.4
	Adiabatic Index		1B	15	15.2
	Age of Solar System & Earth		1A	5	5.2
	Air Showers		1C	26	26.1
	Alnico V		2D	41	41.9
	Alpha Particle	Nucleus of Helium	3A	4	4.7
*	Alternate Gradient Focusing		2C	30	30.7
	AM, Amplitude Modulation		1D	43	43.3
*	Ammonia Maser		3A	11	11.5
*	Ammonia Molecule	in Electric Field	3A	11	11.4
*	Ammonia Molecule	Summary	3A	12	12.7
	Ampere's Law		2B	14	14.4
	Amplitude of Wave		1C	31	31.1
*	Angular Momentum		1D	39	39.4
*	Angular Momentum Conservation	Due to Rotation Symmetry	3B	23	23.5
*	Angular Momentum in QM		2D	38	38.7
*	Angular Momentum Operator in QM		3C	31	31.7
	Angular Velocity	ω	1D	39	39.2
	Anomalous Dispersion		1D	43	43.5
*	Anomalous Refraction		1C	36	36.9
*	Antimatter		1D	49	49.13
*	Antiparticles	How to Make Them	2C	26	26.5
	Archimedean Spirals		2D	44	44.6
	Arrow of Time		1D	49	49.7
*	Astronomy	Relation to Physics	1A	3	3.3
*	Asymmetric Molecule, Ionic		3B	13	13.4
*	Atmosphere, Electric Current		2A	9	9.2

*	Atmosphere, Electric Field Atomic Angular Momentum States	Potential Rises 100 Volts/meter Brief Description	2A 3B	9 16	9.1 16.9	
	Atomic Electrons Orbits	Bhoi Boompton	3A	6	6.4	
	Atomic Force Microscope		2C	30	30.5	
*	Atomic Forces	Forces between Atoms	1A	9	9.2	
	Atomic Hypothesis		1A	1	1.6	
	Atomic Number Z		3C	30	30.4	
*	Atomic Physics	Summary	3A	12	12.8	
	Atomic Polarizability	•	2A	11	11.1	
*	Atomic Radiation	Angular Momentum Considerations	3C	27	27.1	
*	Atomic Radiation	Parity Considerations	3C	27	27.2	
	Atomic Shells	States of Equal Principal Quantum #	3A	6	6.4	
*	Atomic Spectra	Unique Fingerprints	3A	3	3.8	
	Atoms	Element Number	1A	1	1.6	
	Atoms	Isotopes	1A	1	1.6	
*	Atoms		1A	1	1.6	
*	Atoms	Why They Are Stable	3A	3	3.6	
*	Atoms as Harmonic Oscillators		2C	32	32.2	
*	Atoms, Why Stable		2A	5	5.3	
	Averted Vision	Use by Astronomers	1D	48	48.4	
	Avogadro, Amedeo		1B	15	15.1	
	Avogadro's Number	6.022E+23 Carbon-12 atoms/gram	1B	15	15.1	
	Axial Vectors		1D	49	49.10	
	В					
*	Ball, Charged	Electric Field Outside	2A	4	4.9	
*	Ball, Charged Ball, Charged	Electric Field Outside Electric Field Inside & Outside	2A 2A	4 5	5.6	
* *	Ball, Charged Ball, Charged Ball, Charged		2A 2A	5 8	5.6 8.1	
* *	Ball, Charged Ball, Charged	Electric Field Inside & Outside Energy of	2A 2A 1D	5 8 43	5.6 8.1 43.3	
	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn	Electric Field Inside & Outside	2A 2A 1D 1A	5 8 43 5	5.6 8.1 43.3 5.3	
* *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A	5 8 43 5 9	5.6 8.1 43.3 5.3 9.5	
*	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration	Electric Field Inside & Outside Energy of	2A 2A 1D 1A 3A 3B	5 8 43 5 9	5.6 8.1 43.3 5.3 9.5 13.2	
	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B	5 8 43 5 9 13 24	5.6 8.1 43.3 5.3 9.5 13.2 24.6	
* *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B	5 8 43 5 9 13 24 7	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5	
*	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States of Multiple Fermions	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3A 3B	5 8 43 5 9 13 24 7 16	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States Basis Theory of Superconductivity	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3A 3B	5 8 43 5 9 13 24 7 16 33	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3A 3B 3C 2D	5 8 43 5 9 13 24 7 16 33 42	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3A 3B 3C 2D 2D	5 8 43 5 9 13 24 7 16 33 42 42	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3A 3B 3C 2D 2D	5 8 43 5 9 13 24 7 16 33 42 42 33	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Barsis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order Beam Stiffness	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3B 3B 3B 3C 2D 2D 1C 2D	5 8 43 5 9 13 24 7 16 33 42 42 33 42	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2 42.7	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order Beam Stiffness Beat Frequency	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3C 2D 2D 1C 2D 1D	5 8 43 5 9 13 24 7 16 33 42 42 33 42 43	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2 42.7 43.2	
* * * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Barsis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order Beam Stiffness Beat Frequency Beats	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3C 2D 1C 2D 1C 2D 1D	5 8 43 5 9 13 24 7 16 33 42 42 33 42 43 45	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2 42.7 43.2 45.3	
* * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Barsis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order Beam Stiffness Beat Frequency Beats Bell's Inequality	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3C 2D 2D 1C 2D 1D 1D 3C	5 8 43 5 9 13 24 7 16 33 42 42 33 42 43 45 35	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2 42.7 43.2 45.3 35.5	
* * * * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Basis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order Beam Stiffness Beat Frequency Beats Bell's Inequality Bending Moment	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3C 2D 1C 2D 1D 1D 3C 2D	5 8 43 5 9 13 24 7 16 33 42 42 43 45 35 42	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2 42.7 43.2 45.3 35.5 42.7	
* * * *	Ball, Charged Ball, Charged Ball, Charged Bandwidth barn Barrier Penetration Barrier Penetration Barrier Penetration Barsis States Basis States Basis States of Multiple Fermions BCS Theory of Superconductivity Beam Bending Beam Buckling Beam Order Beam Stiffness Beat Frequency Beats Bell's Inequality	Electric Field Inside & Outside Energy of Area of 10x10 fermis	2A 2A 1D 1A 3A 3B 3B 3C 2D 2D 1C 2D 1D 1D 3C	5 8 43 5 9 13 24 7 16 33 42 42 33 42 43 45 35	5.6 8.1 43.3 5.3 9.5 13.2 24.6 7.5 16.3 33.4 42.7 42.8 33.2 42.7 43.2 45.3 35.5	

*	Bernoulli's Theorem Bessel Functions		2D 2B	44 23	44.4 23.2
	Binding Energy	Molecular	1B	18	18.1
	Binding Energy		3A	9	9.6
*	Biology	Relation to Physics	1A	3	3.2
*	Biot-Savart Equation	·	2B	15	15.8
*	Birefringence		1C	36	36.3
*	Black Body Radiation		1B	20	20.2
	Black Hole Event Horizon		2D	46	46.4
	Black Hole Singularity		2D	46	46.4
	Black Holes	Limiting Small Distance	1A	5	5.3
	Black-Body Spectrum	Quantum Mechanics of	3A	6	6.2
	Bloch Sphere		3C	34	34.6
	Blueshift	of approaching light source	1C	37	37.8
	Bohr Magneton		2D	38	38.8
	Bohr Radius	0.529 Angstroms	3A	3	3.5
	Boltzmann's Constant k	1.38E-23 mks	1B	15	15.4
*	Boltzmann's Law		1B	16	16.2
*	Boosts	Compared with Rotations	1C	27	27.3
	Boosts	Changes in Reference Frame Velocity	2C	26	26.2
	Bose-Einstein Statistics	For Identical Particles	3A	5	5.2
	Bose, Satyendra Nath		1B	20	20.5
	Boson Statistics	In-depth Analysis	3A	5	5
*	Boson, N-Particle States	Probabilities vs N	3A	5	5.4
	Bosons		1A	2	2.7
	Bosons		3C	25	25.1
*	Bound States in Particle Scattering	in High Energy Collisions	3B	19	19.5
*	Boundary Conditions	in Reflection of Light	2C	33	33.5
*	Bow Wave		1D	46	46.1
*	Bra-Ket Notation	of Paul Dirac	3A	4	4.2
*	Bremsstralung Radiation		1C	37	37.5
	Brewster's Angle		1C	36	36.7
	Broadcast Multiplexing		1D	43	43.3
	Brown	What is Brown Light?	1D	48	48.5
	Brownian Motion		1A	1	1.2
*	Brownian Motion		1B	17	17.1
	Bubble Chamber		1C	37	37.3
	Bulk Modulus		2D	42	42.2
*	Butadiene Molecule		3B	21	21.8
	С				
	c, Speed of Light	299,792,458 meters/sec	1A	11	11.2
	Calcite, Icelandic Spar	, - ,	1C	36	36.9
*	Calculus	Differential	1A	6	6.2
	Calculus	Integral	1A	6	6.4
	Capacitor	5 -	1B	13	13.3
	•			-	-

*	Capacitor	Energy Stored in	2A	8	8.2	
*	Capacitor	Forces	2A	8	8.3	
*	Capacitor, Parallel Plate		2A	7	7.3	
*	Capacitors	at High Frequency	2B	23	23.2	
	Capacitors, Electrical		2B	22	22.1	
	Carbon-14 Dating		1A	5	5.2	
	Carnot Cycle	Complete cycle	1B	21	21.2	
	Carrier Density, Intrinsic	in Silicon	3B	20	20.3	
*	Carrier Flow, Semiconductor	Electrons & Holes	3B	20	20.2	
	Carrier Mobility in Semiconductors		3B	20	20.2	
	Carrier Wave & Signal Waves		1D	43	43.3	
	Catalysts		1B	18	18.4	
*	Causality		1C	27	27.6	
*	Cavendish Experiment		1A	8	8.8	
*	Center of Mass	of complex body	1D	40	40.1	
*	Center of Mass, CM		1D	39	39.1	
	Centrifugal Pseudo Force		1A	9	9.9	
	Centroid of a Surface		1D	40	40.2	
	CERN		1C	37	37.3	
	Chaos Theory		3A	3	3.9	
	Characteristic Impedance	of Ladder Network	2B	22	22.8	
	Characteristic Polynomial		3B	14	14.4	
*	Charge & Current	Lorentz Transform of 4-Vector p/j	2B	14	14.8	
	Charge Conjugation Symmetry	C Symmetry	1D	49	49.13	
*	Charge Conservation & Current	, ,	2B	14	14.2	
*	Chemistry	Relation to Physics	1A	3	3.1	
*	Cherenkov Radiation	·	1D	46	46.2	
	Chirality		1D	49	49.9	
*	Chromatic Aberration		1C	30	30.9	
	Chromaticity Diagram	CIE 1931	1D	48	48.7	
	Circadian Rhythm	Informed by Ganglia in Eye	1D	48	48.3	
	Circuit Bridge		2B	22	22.5	
*	Circular Fluid Flow		2D	44	44.6	
	Circular Polarization		1C	36	36.2	
	Circulation of Vector Fields		2A	3	3.5	
	Classical Physics	Fails to Compute Specific Heat Ratios	1B	20	20.1	
	Classical Physics	Fails to Compute Black Body Rad.	1B	20	20.2	
*	Classical Physics Failure	To Explain Magnetism	2D	38	38.6	
*	Classical Physics, Equation of		2B	19	19.7	
*	Clausius-Clapeyron equation		1B	22	22.5	
	Claussius-Mossotti Equation		2A	11	11.4	
	Cleaveage Plane, of a Crystal	Plane Crystal is Most Easily Cut	2C	31	31.1	
	Clebsch-Gordon Coefficients		3C	28	28.3	
	Closing Speed or Velocity		1C	26	26.2	
	Coax Cable		2C	25	25.1	
	Coefficient of Viscosity, First		2D	45	45.1	

	Coefficient of Viscosity, Second		2D	45	45.2
	Coercive Force	Field Needed to Reset B to Zero	2D	41	41.9
	Coherent photon beam		1B	20	20.6
	Coherent Waves		1C	31	31.3
	Collision	Mean Time Between Collisions	1B	19	19.1
	Collision	Mean Free Path	1B	19	19.1
*	Collision Kinematics	CM frame Analysis	1B	15	15.5
*	Colloidal Particles in Electrolyte		2C	34	34.4
*	Color Perception		1D	48	48.5
*	Coma, Comatic Aberration		1C	30	30.9
	Commutator, for Electric Motor		2B	17	17.1
*	Commutators of Operators		3C	31	31.8
	Compact Manifold	Topology of Universe	1A	4	4.1
	Complex Conjugate		1B	12	12.5
*	Complex Numbers	Algebra of	1B	12	12.5
	Compression Waves		1D	46	46.4
*	Compression Waves		2D	42	42.6
	Condensation		1B	18	18.1
	Conduction Band		3B	19	19.3
*	Conductivity, Doped Silicon		3B	20	20.4
*	Conductor	No Electric Field Inside even Charged	2A	5	5.9
*	Conductor, Internal Cavity	No Electric Field Inside	2A	5	5.10
	Confined Waves		1D	44	44.3
*	Conservation	of Energy	1A	4	4.1
	Conservation	of Angular Momentum	1A	4	4.7
	Conservation	of Baryons	1A	4	4.7
	Conservation	of Electric Charge	1A	4	4.7
	Conservation	of Leptons	1A	4	4.7
*	Conservation	of Linear Momentum	1A	7	7.6
*	Conservation Laws	Global vs. Local	2C	28	28.1
	Conservation of Charge		2B	19	19.2
*	Conservation of Fermions by Type	In Strong Force & Electromagnetism	3C	26	26.1
	Conservation of Mass	Invalidated by Special Relativity	1C	26	26.3
	Consonance		1D	45	45.3
	Constrained Motion		1A	10	10.2
	Constructive Interference		1C	31	31.3
	Continuity Equation		2D	44	44.3
*	Continuous States & Wave Function		3B	24	24.3
	Contrapositive	Method of Proof	1D	49	49.3
	Contravariant Index of Tensor	in 4-D Spacetime	2D	37	37.4
*	Cooper Pairs	Two Electrons United as One Boson	3C	33	33.4
	Coordinates in 3-D		1A	6	6.5
	Copenhagen Interpretation of QM		3C	34	34.2
	Coriolis Pseudo Force		1A	9	9.9
	Cosmic Microwave Background	CMB Radiation	1D	49	49.13
	Cosmic Rays	How They Reach Earth's Surface	1C	26	26.1

	Cosmic Rays	Discovery by Hess in 1912	2A	9	9.2	
*	Cosmological Redshift	due to expansion of space	1C	37	37.8	
	Coulomb Course	Define divergence(A) = 0	2D	45	45.5	
*	Coulomb Gauge	Define divergence(A) = 0	3C	33	33.6	
	Coulomb's Law		2A	4	4.3	
	Coupling Coefficient of Two Coils	in 4 D Connections	2B	18	18.9	
	Covariant Index of Tensor	in 4-D Spacetime	2D	37	37.4	
*	CP Symmetry Violation	In Navitual Kaana	1D	49	49.13	
	CP Violation	In Neutral Kaons	3C	26	26.5	
*	CPT Symmetry	C,P & T Symmetries Combined	1D	49	49.14	
	Critical Angle		1C	31	31.5	
	Critical Temperature	of Superconductor	3C	33	33.4	
*	Cross Product as Tensor		2D	37	37.8	
	Cross Product of Two Vectors		2A	2	2.2	
	Cross Product Sign Rule		1D	41	41.1	
	Cross Product, Vector		1A	6	6.6	
	Cross Section		1B	19	19.1	
	Cross Section, Scattering		1C	35	35.5	
	Crosstalk		2C	25	25.1	
	Crystal Dislocations		2C	31	31.7	
*	Crystal Growth	Enhanced at Dislocations	2C	31	31.8	
*	Crystal, Formation of		2C	31	31.2	
*	Crystal, Ionic	Binding Energy	2A	8	8.4	
*	Crystals, Chemical Bonds in		2C	31	31.3	
*	Crystals, Structure of		2C	31	31.1	
*	Crystals, Symmetries	in 2-D, Tiling Theory	2C	31	31.4	
*	Crystals, Symmetries	in 3-D	2C	31	31.5	
	Curie Temperature		2D	40	40.4	
	Curie-Weiss Law		2A	11	11.6	
	Curie's Law		2A	11	11.2	
	Curl Operator		2A	2	2.5	
*	Curl, 4-D		2C	27	27.5	
*	Current, Electric	Energy of Constant Current	2B	16	16.4	
	Curvature of Spaces	Positive, Zero & Negative Curvature	2D	46	46.2	
*	Curvature of Spacetime	Positive, Zero & Negative	2D	46	46.4	
*	Curvature of Spacetime	Apparent due to Expanding Rulers	2D	46	46.8	
	Curvature, Radius of	Derivation of General Equation	2D	42	42.9	
	Curves of Elastica	•	2D	42	42.8	
	Cutoff Frequency		2B	22	22.8	
*	Cutoff Frequency		2C	25	25.3	
	Cygnus X-1, 1st Black Hole		1A	8	8.7	
	D					
*	d-orbit	of Electron in Hydrogen	3C	30	30.3	
	D'Alembert Operator	or Electron in Frydrogen	2B	19	30.3 19.6	
	Debye Length		2C	34	34.4	
	Denie religiii		20	54	J 4 .4	

	Decay Eigenstates	Complex Hamiltonian Amplitudes	3C	26	26.3
	Decibels		1D	42	42.4
	Degenerate Doping	in Semiconductors	3B	20	20.3
	Degrees of Freedom	Polyatomic Molecules	1B	20	15.8
	Degrees of Freedom, for Motion		1B	15	15.4
*	Derivatives	Definition	1A	6	6.3
	Destructive Interference		1C	31	31.3
*	Diamagnetism		2D	38	38.4
	Diamond Crystal		3B	20	20.1
	Dielectric Constant		2A	10	10.1
*	Dielectric Gases, Polar		2A	11	11.2
*	Dielectric Liquids		2A	11	11.4
*	Dielectric Solids		2A	11	11.5
*	Dielectric, Gases, Non-Polar		2A	11	11.1
*	Dielectrics	EM Equations in	2C	32	32.3
*	Dielectrics, Historical Notation	D and H Fields	2C	32	32.8
*	Dieletric Materials		2A	10	10
	Differential Equations	Many Problems With Same Equations	1B	12	12.1
*	Differential Equations	Linear	1B	12	12.1
*	Diffraction		1C	31	31.6
*	Diffraction		1C	33	33.1
*	Diffraction	Due to Aperture	1C	34	34.5
*	Diffraction Gratings	•	1C	33	33.2
	Diffusion Coefficient		1B	19	19.4
	Diffusion Equation		1B	19	19.4
*	Diffusion Equation, Einstein		1B	17	17.3
	Dimensional Analysis		1A	6	6.1
*	Dimensional Analysis	Dropping & Restoring c's	2C	26	26.3
	Dipole Moment	Induced in Dielectric by External Field	2A	10	10.2
*	Dipole Radiator / Antenna		1C	32	32.6
	Dirac delta function		1B	14	14.4
	Dirac Delta Function		3B	22	22.5
	Dispersion		1D	46	46.4
	Dissonant		1D	45	45.3
*	Distance	Measuring	1A	5	5.3
	Distance	Scale Spans 62 digits	1A	5	5.3
	Distinguishability & Interference	Coald Opario of digital	3A	2	2.6
	Divergence Operator	same as Gradient	2A	2	2.5
	DNA	tautomeric mutations	1A	3	3.2
	Doping, in Semiconductors	Addition of Impurity Atoms to Crystal	3B	20	20.3
*	Doppler Effect	Light Frequency Shift due to Motion	1C	37	37.8
	Dot Product of Two Vectors	Light Frequency Chilt due to Motion	2A	2	2.2
	Dot Product, Vector		1A	6	6.6
*	Drag Coefficient		2D	45	45.4
	Drain, Water Flowing Down Into		2D	45 44	44.6
*	Drift Velocity		1B	19	19.2
	2 70100119		.0	.0	10.2

*	Drumhead Vibration "Dry" Water		2A 2D	12 45	12.3 45.1
*	Dyes	Strong Absorbers of Specific Colors	3B	13	13.10
	2,00	chang, because of openine colors	U.D.	.0	10.10
	E				
*	$E = mc^2$	Derivation and discussion	1C	26	26.4
	e, Charge of Elementary Particle	1.602E-19 Coulombs	1A	11	11.2
	e, Elementary Charge		1C	35	35.2
	Earth, Internal Structure		1D	46	46.4
	Earth's atmosphere	as a driven oscillator	1B	13	13.4
	Earthquakes		1D	46	46.4
	Eddy Currents		2B	17	17.4
	Effective Potential	of Orbits with Angular Momentum	3C	29	29.5
	Efflux Coefficient		2D	44	44.5
	Eigenstate		3B	14	14.4
	Eigenvalue		3B	14	14.4
	Eigenvector		3B	14	14.4
	Einstein	Solves Brownian motion	1B	17	17.1
	Einstein	Proves atomic hypothesis	1B	17	17.1
	Einstein	Solves Photoelectric effect	1B	20	20.5
	Einstein Summation Convention	Sums of Repeated 4-Vector Indices	1C	27	27.2
*	Einstein's Laws of Radiation		1B	20	20.5
*	Elastic Collisions		1A	7	7.8
*	Elastic Constants, Computing the		2D	43	43.6
*	Elasticity Dynamics	Objects Not in Equilibrium	2D	43	43.4
*	Elasticity Tensor		2D	43	43.3
	Electrets	Solids with Permanent Polarization	2A	11	11.5
*	Electric & Magnetic Fields	General Description	2A	1	1.4
*	Electric Dipole Component	of Fields from Complex Distributions	2A	6	6.4
*	Electric Dipole Field		2A	6	6.2
	Electric Dipole Radiation		3C	27	27.2
*	Electric Field	Electrostatic Field Energy	2A	8	8.6
*	Electric Field & Equilibrium	No Stable Place in Electrostatic Field	2A	5	5.1
*	Electric Field Divergence		2A	4	4.7
*	Electric Field in Dielectrics		2A	10	10.6
*	Electric Field in Dielectrics	In Vertical, Horizontal & Spherical Void	2A	11	11.3
*	Electric Field Lines		2A	4	4.10
*	Electric Potential	for Discrete & Continuous Charges	2A	4	4.4
*	Electric Potential	of Two Offset Cylinders	2B	15	15.5
*	Electric Potential, Gradient of		2A	4	4.5
	Electric Susceptibility	of Dielectric	2A	10	10.3
	Electrical Circuit Elements	Two-Terminal Devices	2B	22	22.1
*	Electrical circuits	Parallel & Serial	1B	13	13.6
*	Electrical Circuits		2B	22	22
*	Electricity, Power of		2A	1	1.1
*	Electrodynamics in 4-D		2C	26	26.7

*	Electrodynamics in 4-D	Fields of Moving Charge	2C	26	26.8
*	Electromagnetic Energy Flow	ricids of Moving Orlange	2C	28	28.4
*	Electromagnetic Equations	For Any Conditions	2B	16	16.6
*	Electromagnetic Field	1 of Arry Cortations	1A	2	2.3
*	Electromagnetic Field Energy		2C	28	28.2
*	Electromagnetic Field Momentum		2C	28	28.5
*	Electromagnetic Field Momentum	of Moving Charge	2C	29	29.3
	Electromagnetic Fields	and Wave Equation	2B	19	19.6
*	Electromagnetic Fields	Wave Solutions in Vacuum, in 1-D	2B	20	20.1
*	•	Wave Solutions in Vacuum, in 3-D	2B	20	20.1
*	Electromagnetic Fields	ŕ	2B	20	20.5
*	Electromagnetic Fields	Spherical Wave Solutions in Vacuum	2B		20.5
*	Electromagnetic Fields	from Any Charge Motion		21	21.1
*	Electromagnetic Fields	from Point Source	2B	21 21	21.2
*	Electromagnetic Fields	from Extended Source	2B		
*	Electromagnetic Fields	from Electric Dipole	2B	21	21.4
*	Electromagnetic Fields	Constant Velocity Transform of	2C	27	27.3
	Electromagnetic Fields	Lorentz Transformation of	2C	27	27.7
	Electromagnetic Fields	Lorentz Transformation Equations	2C	27	27.11
*	Electromagnetic Fields & Light	Why Speed of Fields is c	2B	19	19.5
*	Electromagnetic Fields & Motion	0	2B	19	19.4
	Electromagnetic Laws	Stated in Words	2A	1	1.6
*	Electromagnetic Mass		2C	29	29
*	Electromagnetic Potentials	Constant Velocity Transform of	2C	27	27.1
*	Electromagnetic Radiation		1C	32	32.1
*	Electromagnetic Static Equations		2B	16	16.5
*	Electromagnetic Waves	in Dense Matter	2C	33	33.3
	Electromagnetism	Classical Theory of Low-Energy Light	1C	30	30.1
*	Electromagnets		2D	41	41.4
	Electrometer	Measures Electric Charge	2A	9	9.2
	Electron		1A	1	1.6
	Electron		3C	25	25.1
	Electron Effective Mass	in a Crystal	3B	18	18.5
	Electron Gas		1B	18	18.3
*	Electron in Crystal with Impurity	Scattering by Impurity	3B	19	19.3
*	Electron in Crystal with Impurity	Scattering Calculations	3B	19	19.6
*	Electron in Crystal with Impurity	Trapping by Impurity	3B	19	19.4
	Electron Radius, Classical	2.8 fermi	2C	29	29.3
	Electron Radius, Classical	2.8 fm, an old, wrong guess	1C	35	35.3
	Electron Shell Number		3A	3	3.7
	Electron Shielding	of Outer Orbits by Inner Orbits	3C	30	30.4
	Electronegativity		3A	11	11.4
*	Electronic Circuit Elements	at High Frequency	2B	23	23.1
*	Electronic Circuits	Serial & Parallel	2B	22	22.4
*	Electronic Circuits	Complex Circuits	2B	22	22.5
*	Electronic Circuits	Equivalent Circuits	2B	22	22.6
*	Electronic Circuits	Energy in Circuits	2B	22	22.7

*	Electronic Circuits	Ladder Networks	2B	22	22.8
*	Electronic Circuits	Frequency Filters	2B	22	22.9
*	Electronic Circuits	Exotic	2B	22	22.11
	Electrons		1A	2	2.7
*	Electrons in 1-D Crystals		3B	18	18.2
*	Electrons in 3-D Crystals		3B	19	19.1
*	Electrons in Atoms & More	also Molecules & Crystals	3B	24	24.5
*	Electrostatic Equations		2A	4	4.2
*	Electrostatic Equations	in Dielectrics	2A	10	10.5
	Electrostatic Equations	in Dielectrics, Alternative Notation	2A	10	10.5
*	Electrostatic Lens	to Focus Charged Particles	2C	30	30.3
	Elementary Particle	Generations	1A	2	2.7
*	Elementary Particles	Matter not made of anything smaller	1A	2	2.7
*	Elementary Particles		3C	25	25.1
	Elements	Abundance in Cosmos & in Life	1A	1	1.6
	Elliptical Mirror		1C	31	31.4
	Elliptical Polarization		1C	36	36.2
	Emergent Phenomena		1B	23	23.5
	Emergent Phenomena		1D	40	40.3
	EMF, Back		2B	18	18.8
	EMF, Electromotive Force		2B	17	17.2
*	EMF, Induced	Similarity to Viscous Force	2B	18	18.6
*	Energy	Gravitational Potential	1A	4	4.3
*	Energy	Kinetic	1A	4	4.5
	Energy	Chemical	1A	4	4.6
	Energy	Elastic	1A	4	4.6
	Energy	Heat	1A	4	4.6
	Energy	Mass	1A	4	4.6
	Energy	Radiation	1A	4	4.6
*	Energy Conservation	Due to Time Translation Symmetry	3B	23	23.6
*	Energy Ellipsoid		2D	37	37.6
	Energy Matrix		3A	10	10.7
*	Energy Theorem of Fourier Series		1D	45	45.7
*	Entanglement		3C	27	27.5
*	Entanglement of Wavefunctions		3C	34	34.4
*	Entropy		1B	21	21.6
*	Entropy	Equation for	1B	23	23.6
	Enzymes		1B	18	18.4
*	EPR - Einstein Paper of 1935	Claims QM is Incomplete	3C	35	35.1
*	EPR Experiments	Observational Results	3C	35	35.6
*	EPR Experiments	Interpretation of Results	3C	35	35.7
	EPR Paradox	Einstein, Rosen, Podolsky	3A	2	2.6
*	EPRB - Bohm Formulation		3C	35	35.2
	epsilon-zero	8.854E–12 mks	1A	11	11.2
*	Equations of Motion	for Relativistic 4-D	2C	27	27.8
	Equipartition Principle		1B	15	15.4

*	Facilitation - Debuginle - Finalisis		0.0	40	40.0	
*	Equivalence Principle, Einstein		2D	46	46.3	
	Ether, Luminiferous		1C	25	25.4	
	Ethylene Molecule		3B	21	21.6	
	Euler Force		2D	42	42.7	
	Euler's Identity		1B	12	12.5	
	eV - electron-volt	1.602E–19 Joules	1A	2	2.7	
*	Evaporation		1B	18	18.1	
	Event Horizon	of Black Hole	2D	37	37.4	
	Excess Radius		2D	46	46.4	
	Excitation Energy	(Excited State – Ground State) Energy	2A	8	8.5	
*	Excitation Energy	Comparison of Various Types	3A	11	11.3	
	Exciton	Extra Energy Mobile in a Crystal	3B	19	19.2	
*	Exclusion Principle, Pauli		3A	4	4.7	
	Exclusion Principle, Pauli		3A	6	6.4	
	Expectation Value		3C	31	31.2	
	F					
	Faraday Tensor	E & B Fields in Relativistic 4-D Form	2C	27	27.11	
	Faraday's Law	L & B Fleids in Relativistic 4-B Form	2B	18	18.1	
	Fermi-Dirac Statistics	For Identical Particles	3A	5	5.2	
			3C		26.1	
	Fermion Type Transmutation	In Weak Force		26		
	Fermions		1A	2	2.7	
	Fermions	On any animal of	3C	25	25.1	
	Fermions & Bosons	Comparison of	3A	5	5.2	
*	Ferroelectricity		2A	11	11.6	
*	Ferromagnetic Materials	Special Types	2D	41	41.9	
*	Ferromagnetism		3B	21	21.1	
*	Ferromagnetism is Quantum Effect	a Quantum Explanation	2D	40	40.5	
*	Ferromagnetism, Thermodynamics		2D	41	41.6	
	Feynman Diagram		3B	13	13.5	
	Feynman Diagrams		1A	2	2.6	
*	Feynman Path Integral Formulation		1C	31	31.7	
*	Feynman Sums Over History		1C	31	31.7	
	Fiber Optics		2C	33	33.8	
*	Field Concept & Value		2A	1	1.8	
*	Field Emission Microscopy		2A	7	7.5	
	Field Energy of E or B		2B	18	18.9	
	Field Equations	of Einstein's General Relativity	2D	37	37.4	
*	Field from a Grid	Grid of Parallel Line Sources	2C	34	34.5	
*	Field Momentum Tensor		2D	37	37.11	
	Fields wit Zero Curl	Equal Gradient of Some Scalar Field	2A	2	2.8	
	Fields with Zero Divergence	Equal Curl of Some Vector Field	2A	2	2.8	
*	Fields, First Derivatives of	•	2A	2	2.4	
*	Fields, Philosophy of		2B	_ 15	15.9	
*	Fields, Second Derivatives of		2A	2	2.8	
*	Fields, Vector & Scalar		2A	2	2.3	
			`	_	0	

*	Fields, with Zero Curl	Are Gradients of A Scalar Field	2A	3	3.7
	Fine Structure Constant	$1/\alpha = 137.035,999,14$	3A	3	3.5
	Finite used to mean Nonzero	Common Imprecise Physics Jargon	3B	20	20.2
*	Fluid Flow Equation	of Uncharged Fluids	2D	44	44.3
	Fluid Vorticity		2D	44	44.3
	Fluid, Irrotational Flow	Fluid Flow Without Vorticity	2D	44	44.3
	Fluid, Irrotational Flow	Once Irrotational, Always Irrotational	2D	44	44.3
	Flux	Net Flow Through Surface / Unit Time	2A	1	1.5
	Flux Rule		2B	17	17.2
*	Flux Rule Cautions		2B	18	18.2
	FM, Frequency Modulation		1D	43	43.3
*	Force	Definition	1A	7	7.3
*	Force	Definition & Character of	1A	9	9
*	Force	as Classical Limit of QM	3A	9	9.7
	Force 4-Vector	"4-force"	2C	27	27.8
	Force-Deformation Equation	"1st General Principle of Elasticity"	2D	42	42.1
	Force, Conservative	All Fundamental Forces Are	1A	10	10.4
*	Force, Electromagnetic		1A	9	9.4
*	Forces, Fundamental		1A	9	9.3
	Forces, Pseudo		1A	9	9.9
*	Four Vectors		2C	26	26.2
*	Four-vectors		1C	27	27.1
*	Four-vectors	Einstein Conventions	1C	27	27.2
*	Fourier Series		1D	45	45.2
*	Fourier Transform		1D	45	45.6
*	Fourier transforms		1B	14	14.4
	Frequency of Wave		1C	31	31.1
	Fresnel Reflection Formulas		1C	36	36.6
*	Friction		1A	9	9.1
*	Functions Near Extrema	Why Slowly Varying	2D	36	36.2
*	Functions of a Complex Variable	viriy Glowly varying	2C	34	34.2
*	Fundamental principles of QM	Summary	3A	12	12.1
	i undamental principles of Qivi	Guillinary	57	12	12.1
	G				
	g, Earth Gravity Acceleration	9.80665 m/sec-squared	1A	6	6.1
	G, Newton's Gravitational Constant	6.67384E-11 mks	1A	11	11.2
*	Galilean Transformation		1A	9	9.8
	Galilean Transformation		1C	25	25.3
*	Galileo Galilei	First Experimenter	1A	5	5.1
	Gallium Arsenide	Semiconductor	3B	20	20.1
	Galvanometer	Measures Electric Current	2A	9	9.1
*	Gauss' Law	Divergence of E ~ Charge Density	2A	4	4.8
*	Gauss' Theorem	3	2A	3	3.3
	General Relativity		1C	25	25.2
*	General Relativity on Gravity		1A	8	8.10
*	Generator, Current AC		2B	18	18.5
	,			-	

*	Generator, Current DC		2B	17	17.2
	Geodesics	Trajectories of Force-Free Particles	2D	46	46.7
*	Geometric Optics	Theory of Medium-Energy Light	1C	30	30.1
*	Geometry in 2-D: Plane & Curved	3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3	2D	46	46.2
	Germanium	Semiconductor	3B	20	20.1
	GeV - 1 billion electron-volts		1A	2	2.7
	Global Properties of Substances		1B	21	21.6
	Gluon		3C	25	25.1
	Gluons		1A	2	2.7
	Golden Ratio	ø = 1.618; ø–1 = 1/ø	3B	21	21.8
	Gradient	Spatial Derivative of Scalar Field	2A	2	2.4
*	Gradient Operations	Spatial Delivative of Scalar Field	2A	2	2.5
	Gradient Operator		1A	10	10.5
*	Gradient, 4-D		2C	26	26.6
		in Motel Crystale	2C		31.7
*	Grain Boundary	in Metal Crystals		31	
	Gravitational Potential Energy	The state of a state of Constitution	1A	10	10.4
	Graviton	Hypothetical Carrier of Gravity	3A	4	4.5
*	Gravity		1A	8	8
*	Gravity	Many Bodies	1A	10	10.6
*	Gravity	from Plane	1A	10	10.7
*	Gravity	from Ball	1A	10	10.8
*	Gravity	Inside a Shell	1A	10	10.9
*	Gravity & Light	Light Redshifts Rising Against Gravity	2D	46	46.6
*	Gravity: Newton vs. Einstein		2D	46	46.1
	Great Circle Routes	Geodesics on a Sphere	2D	46	46.7
*	Green's function method		1B	14	14.4
	Ground State		3A	3	3.7
*	Group Velocity		1D	43	43.5
	Gyromagneetic Ratio	of Key Elementary Particles	2D	38	38.2
*	Gyroscope		1D	41	41.2
	H Dianak's Constant	6.626E-34 mks	1 ^	11	11.2
	h, Planck's Constant	0.020E-34 IIIKS	1A	11	
	Half-Life	-file-stable Otata	1A	5	5.2
	Half-life	of Unstable State	3A	9	9.6
*	Hall Effect	T. T. O	3B	20	20.5
*	Hamiltonian	The Time Operator	3A	10	10.7
	Harmonics		1D	45	45.2
*	Harmonics Oscillators		1B	12	12.2
	HDTV		1D	43	43.3
	Heat Diffusion Equation	Common 2nd Order Differential Eqn.	2A	3	3.4
*	Heat engine	Definition	1B	21	21.2
*	Heat engine	Efficiency of Reversible	1B	21	21.5
*	Heat engine, Reversible		1B	21	21.4
	Heat Flow	Example of Vector Algebra	2A	2	2.8
*	Heat Flow		2A	12	12.2

	Heat Reservoirs		1B	21	21.4
	Heisenberg Uncertainty Principle		1D	45	45.6
	Heisenberg Uncertainty Principle		3A	2	2.1
	Hermitian	H = H*	3C	31	31.1
	Hermitian Matrix		3B	14	14.2
	Hertz or Hz		1C	31	31.1
	Hidden Variable Theories	Failed Attempts to Avoid Uncertainty	3A	2	2.6
	Hidden Variables	,	1A	2	2.6
	Hidden Variables	Undiscovered Elements of Reality	3C	35	35.1
	Higgs Boson		1A	2	2.7
	Higgs Boson	Spin Zero Boson	3A	4	4.5
	Higgs Boson	Sp 2010 2000.	3C	25	25.1
	High Pass Filter		2B	22	22.9
*	High Voltage Breakdown		2A	7	7.4
	Hole, Electron	A Missing Electron in a Crystal	3B	19	19.2
	Homogeneous Space	,	1D	49	49.2
	Hooke's Law		1A	7	7.3
	Hooke's Law	Springs	1B	12	12.2
	Hooke's Law	CPI III IS	2D	42	42.1
	Hoover Dam	Engineering Marvel	2B	17	17.4
	Human Radioactivity	7000 decays/sec	1A	5	5.2
*	Hydrogen Atom	Schrödinger's Eqn: All Electron States	3C	29	29.1
*	Hydrogen Atom	Why Orbits Are Quantized	3C	29	29.3
*	Hydrogen Atom	Orbits with Zero Angular Momentum	3C	29	29.2
*	Hydrogen Atom	Orbits with Angular Momentum	3C	29	29.4
*	Hydrogen Atom	Complete Solution for Electron States	3C	29	29.7
*	Hydrogen Atom, Size of	Derived from Uncertainty Principle	3A	3	3.5
*	Hydrogen Ground State	Hyperfine Splitting	3B	16	16.1
*	Hydrogen Ground State	Hamiltonian of Spin Sates	3B	16	16.4
*	Hydrogen Molecule, Ionic	Transman of Opin Cares	3B	13	13.1
*	Hydrogen Molecule, Neutral		3B	13	13.8
*	Hydrostatics		2D	44	44.2
*	Hyperfine Splitting	of Four Two-Spin States	3B	16	16.7
*	Hysteresis Curve of Magnetism	от обт. то ориг отого	2D	41	41.1
	Hysteresis Loops		2A	11	11.6
	,			• •	
	I				
	Ice	Buoyancy, Importance of	1A	1	1.9
*	Ideal Gas Law		1B	15	15.9
	Identical Particle Statistics	for Fermions & Bosons	3A	5	5.2
*	Identical Particles	How Identical Are They?	3A	5	5.1
	Identity Matrix	•	3A	8	8.4
*	Illumination of Plane Uniformly		2A	12	12.6
*	Image Charges		2A	7	7.2
	Imaginary Numbers		1B	12	12.5
*	Imagination & Science		2B	20	20.4

	Impact Parameter		1D	39	39.3
	Impedance of Electrical Circuits		1B	13	13.6
	Impedance of Vacuum	377 Ohms = ε-zero * c	1C	35	35.1
	Impedance, Electrical		2B	22	22.1
	Independent Motion		1A	8	8.5
*	Independent Particle Approximation		3B	21	21
*	Index of Refraction	Derivation	1C	34	34.2
	Index of Refraction	n	2C	32	32.3
*	Index of Refraction	when a Complex Number	2C	32	32.4
*	Index of Refraction	of Mixed Materials	2C	32	32.5
*	Inductance	Energy of Magnetic Field	2B	18	18.9
*	Inductance, Mutual		2B	18	18.7
*	Inductance, Self		2B	18	18.8
	Induction, Magnetic		2B	17	17.2
	Inductor		1B	13	13.3
	Inductors, Electrical		2B	22	22.1
*	Inelastic Collisions		1A	7	7.8
	Inertia Reference Frames		1A	9	9.9
*	Inertia Tensor		2D	37	37.7
	Inertial Frame		1C	25	25.2
*	Infinite Series with Finite Sum		1A	6	6.9
*	Infinity & Zero	Challenges of Physical Theories	2C	29	29.1
	Infrasonic Waves of Elephants	Below 20Hz, sound travels farther	1D	42	42.3
*	Initial Conditions		1B	12	12.3
*	Insulators & Electric Fields		2A	10	10.1
*	Integrals		1A	6	6.4
	Integrals	Definite	1A	6	6.4
	Integrals	Indefinite	1A	6	6.4
*	Integrals, Line		2A	3	3.1
	Intensity of Wave		1C	31	31.3
*	Interference		1C	31	31.3
*	Interference	When Waves Do & Do Not Interfere	1C	35	35.4
	Interference Fringes		1C	31	31.3
	Interferometer		1C	25	25.4
	Intermediate Vector Bosons		1D	49	49.12
*	Interpretations of QM	Comparisons of Alternative Ideas	3C	34	34.2
	Interstellar Gas Ionization		1B	18	18.3
	Invariance		1C	25	25.3
*	Invariance	Importance in Natural Laws	2C	26	26.1
	Invariant Interval	Importance in Natarai Zawe	1C	27	27.2
	Invariant Interval	in 4-D Spacetime	2D	37	37.4
*	Inverse-Square Law	How Exact Is It?	2A	5	5.8
*	Inverse-Square Law & E Field	The Exact is it.	2A	4	4.6
	Ion Implantation	in Semiconductor Crystals	2C	31	31.7
	Ion Mobility	Commoditation orystals	1B	19	19.3
	Ionic Bond		3B	13	13.8
	IOTHC DONG		JD	13	13.0

*	Ionic Conductivity Ionization Energy Iron-Core Inductance Iron, Hard Iron, Soft Isothermal Isotopes of Elements Isotropic Space	Expansion & Compression	1B 1B 2D 2B 2B 1B 3C 1D	19 18 41 17 17 21 30 49	19.3 18.3 41.2 17.2 17.2 21.4 30.4 49.3
*	J Johnson Noise Josephson Junction Joule heating joules Just Intonation, Musical Scale	Unit of Energy, 1 newton-meter	1B 3C 1B 1A 1D	17 33 13 10 45	17.1 33.9 13.5 10.3 45.3
*	K Kaon Kaon	Neutral Kaon Physics	1D 3C	49 26	49.12 26
*	Kaon Particle Kaon Regeneration	The Pais-Piccioni Effect	1C 3C	37 26	37.3 26.4
	Kelvin Temperature Scale	THE Fais-Ficcion Effect	1B	15	15.4
*	Kepler's Three Laws		1A	8	8.1
	keV - 1000 electron-volts		1A	2	2.7
	kilowatt-hours	3.6 million joules	1A	10	10.3
*	Kinetic Energy	•	1A	10	10.1
	Kinetic Theory &Thermodynamics	Each is Best Sometimes	1B	22	22.5
*	Kinetic Theory of Gases		1B	15	15.1
*	Kirchhoff's Network Rules		2B	22	22.3
	Kronecker Delta		2D	37	37.3
	Kronecker Delta		3A	7	7.5
	L				
	Lagrange's Formula	$Ax(BxC) = B(A \cdot C) - C(A \cdot B)$	1C	37	37.10
	Lagrangian		2D	36	36.7
*	Lambda-Zero Decay		3C	25	25.2
	Lame Elastic Constants		2D	43	43.3
	Laminar Flow		2D	45	45.4
*	Lamor's Theorem		2D	38	38.5
	Lande g-Factor	for Magnetic Moment of Atoms	2D	38	38.2
*	Laplace Equation	10 101 "	2C	34	34.1
*	Laplace's Equation	and General Solutions	2A	6	6.1
*	Laser pumping		1B	20	20.6
.,	Lasers Lateral Contraction due to Stress	"2nd Conoral Principle of Electicity"	1B ' 2D	20 42	20.6 42.1
	Lattice Parameters, of a Crystal	"2nd General Principle of Elasticity"	2D 2C	42 31	42.1 31.1
	Lattice i didifficiers, of a Orystal		20	J 1	01.1

*	LCD Displays		1C	36	36.5	
	Legendre Functions		3C	29	29.4	
*	Length Contraction		1C	26	26.2	
	Lens Equation		1C	30	30.7	
	Lenz's Rule		2B	17	17.3	
	Leptons		1A	2	2.7	
	Leptons		3C	25	25.1	
	Lever Arm of Force		1D	39	39.3	
	LHC	Left Hand Circular Polarization	1C	36	36.2	
	LHC, Large Hadron Collider	Leit Harid Circular i Giarization	1C	37	37.3	
*	Lienard-Wiechert Equation		2B	21	21.5	
	Light	Constant velocity c	1C	25	25.5	
	Light	Comprised of E & B Fields	1C	31	31.2	
*	Light	Absorption by Matter	3A	11	11.8	
	Light Cones	Past and Future	1C	27	27.6	
	Light Intensity	Equation for I vs. Electric Field E	1C	34	34.4	
	Light Pressure	Equation for 1 vs. Electric Field E	1C	37	37.10	
*	_		3C	37 27	27.3	
*	Light Nature of	Einstein's discoveries	3C 1C		27.3 25.5	
*	Light, Nature of			25 24	25.5 34.1	
*	Light, Speed of	Light's Speed is Always c	1C	34		
*	Lightning		2A	9	9.3	
*	Lightning	Number of Independent Colutions	2A	9	9.6	
	Linear differential equations	Number of Independent Solutions	1B	14	14.5	
	Linear Polarization		1C	36	36.2	
*	Linear Superposition	of Fields	1A	9	9.5	
	Linear Superposition	of Fields	2A	1	1.3	
*	Linear Superposition in Elasticity	"3rd General Principle of Elasticity"	2D	42	42.1	
	Linear systems	Theory	1B	14	14.3	
	Liquid Helium	Idaa that All Antion is Lacel	3A	6	6.3	
*	Locality	Idea that All Action is Local	3C	35	35.1	
	Long Ocean Waves	Restoring force is gravity	1D	46 46	46.7	
	Longitudinal Waves		1D	46 27	46.4	
*	Lorentz Covariant	F = @ (F B)	1C	27	27.1 1.2	
	Lorentz Force	F = q (E + v x B)	2A	1		
	Lorentz Course	Relativistic Form in 4-D	2C	27	27.11	
*	Lorentz Gauge Lorentz Transformation	$div{A} = -\partial \emptyset/\partial t / c^*c$	2B	19 25	19.6	
*		Davissed from Massauella Equations	1C	25	25.6	
	Lorentz Transformation Lorentz Transformation	Derived from Maxwell's Equations	2B	21	21.6	
			2C	26	26.2	
	Lorentz-FitzGerald Contraction		1C	25	25.4	
	Low Pass Filter		2B	22	22.9	
	M					
	Mach Number		2D	45	45.3	
	Macroscopic Irreversibility	Driven by Probability	1B	23	23.5	
	Madame Wu Experiment		1D	49	49.11	

*	Mag. Moment & Angular Momentum		2D	38	38.2
	Magic Numbers	Proton & Neutron Numbers in Nuclei	3B	21	21.10
*	Magnetic Cooling		2D	39	39.6
*	Magnetic Dipole Field		2B	15	15.7
	Magnetic Dipole Radiation		3C	27	27.2
*	Magnetic Dipoles	Forces on	2B	16	16.1
*	Magnetic Dipoles	Energy of	2B	16	16.2
*	Magnetic Domains		2D	41	41.8
*	Magnetic Effect on Moving Particles	Phase Shift due to Vector Potential	3C	33	33.11
*	Magnetic Energy of Atoms		2D	38	38.8
*	Magnetic Field	from Wire	2B	14	14.5
*	Magnetic Field	from Solenoid	2B	14	14.5
	Magnetic Field Index	Rleative Gradient of Focusing Field	2C	30	30.6
*	Magnetic Flux Quantization	_	3C	33	33.7
*	Magnetic Force	on Currents	2B	14	14.3
*	Magnetic Force	on Moving Charge	2B	14	14.4
*	Magnetic Lens	Dipole	2C	30	30.4
	Magnetic Lens	Quadrupole	2C	30	30.7
	Magnetic Levitation		2B	17	17.4
*	Magnetic Matter		2D	38	38
	Magnetic Moment	of Particles & Atoms	2D	38	38.2
*	Magnetic Moment Precession		2D	38	38.3
	Magnetic Permeability		2D	41	41.2
	Magnetic Susceptibility		2D	39	39.5
*	Magnetism & Relativity		2B	14	14.6
*	Magnetism as Relativistic Effect		2A	1	1.9
*	Magnetism as Relativistic Effect		2B	14	14.7
*	Magnetism Isn't	Due to Magnetic Currents	2D	40	40.3
*	Magnetism Isn't	Unpaired Moments	2D	40	40.4
*	Magnetism Isn't	Like Polarization	2D	40	40.2
*	Magnetostatics		2B	14	14
	Magnetostriction		2D	41	41.8
	Magnon		3B	21	21.2
*	Many-Worlds Interpretation		3C	34	34.3
*	Mass, Relativistic		1C	26	26.3
*	Material Failure Modes		2D	43	43.5
	Mathematical Induction Principle		2D	38	38.9
*	Mathematics	Relation to Physics	1A	3	3.4
*	Matrices		3B	24	24.2
*	Matrix Arithmetic	for Quantum Operators	3B	14	14.2
*	Matrix Determinants	"Det"	3B	14	14.6
*	Matrix, Diagonal	Lincold Disease	3B	14	14.5
	Matter	Liquid Phase	1A	1	1.7
	Matter	Gas Phase	1A	1	1.8
*	Matter Dhagas of	Solid Liquid or Coo	1A	1	1.9
	Matter, Phases of	Solid, Liquid or Gas	1B	16	16.3

	Max Planck	Quantizes Atomic Emission	1B	20	20.3
*	Maxwell's Demon		1B	23	23.3
*	Maxwell's Equations	in Vector Form	2A	2	2.6
*	Maxwell's Equations	in Vector Form	2A	4	4.1
*	Maxwell's Equations		2B	19	19.1
*	Maxwell's Equations	in 4-D Form	2C	26	26.9
	Maxwell's Equations & Relativity	Question of compatibility	1C	25	25.3
	Mean Free Path	, , , , , , , , , , , , , , , , , , ,	1B	19	19.1
	Mean Lifetime	of Unstable State	3A	9	9.1
*	Measurement	of System with a Discrete Basis	3C	31	31.2
*	Measurement	of System with a Continuous Basis	3C	31	31.3
*	Meissner Effect	or cystem with a continuous Busis	3C	33	33.6
	Mesons		3B	13	13.6
*	Metals, Crystal Structure		2C	31	31.7
	Metric Tensor	of General Relativity	2D	37	37.4
		of General Relativity			2.7
	MeV - 1 million electron-volts	1007	1A	2	
	Michelson-Morley Experiment	1887	1C	25	25.4
	Microelectromechanical Systems	MEMS	2D	41	41.8
	Minor of a Matrix		3B	14	14.6
	Modes of Oscillation		1D	44	44.2
	Modifying Quantum States	Without Disrupting Coherence	3C	34	34.6
	Modulation, in Nonlinear Systems		1D	45	45.8
*	Molecular Stability		3B	21	21.9
*	Molecular Topology	Impact of Atomic Orbits	3C	30	30.5
*	Moment of Inertia		1D	39	39.6
•	Moment of Inertia	of complex body	1D	40	40.4
*	Moment of Inertia	of Some Common Shapes	1D	40	40.5
*	Momentum Conservation	Due to Spatial Translation Symmetry	3B	23	23.6
*	Momentum of Light		1C	37	37.10
*	Momentum Operator in QM	(ħ/i) (∂/∂x)	3C	31	31.5
	Momentum Operators	for Linear & Angular Momenta	3B	23	23.6
*	Momentum States, Continuous	Normalization of	3B	22	22.4
*	Momentum, Types in Magnetic Field	Types: "mv" & "p=mv+qA"	3C	33	33.3
	Mossbauer Effect	. ,	1B	13	13.4
*	Motion		1A	6	6.1
*	Motors, Electromagnetic		2B	17	17.1
*	Multi-State Systems		3B	14	14.4
	mv-Momentum	Normal Newtonian Momentum	3C	33	33.3
	mv Womentam	Normal Newtonian Womentain	00	00	00.0
	N				
*	N-State Systems		3B	14	14.4
	n-type Semiconductor	Region with Excess Negative Carriers	3B	20	20.3
*	Nature's Unity	Togion with Excess Hogative Camers	2A	12	12.7
	Negative Carriers	Free Electrons in Crystal	3B	20	20.2
	_		эв 1А	20 8	8.7
	Neptune Nerst, Walther	Discovery Entropy Theorem	1B	8 21	8. <i>7</i> 21.6
	incist, Waltifel	спиору плеогені	ID	۷ ا	Z 1.U

	Neutral Particle Oscillations		3C	26	26.3
	Neutral Surface		2D	42	42.7
	Neutrinos		1A	2	2.7
	Neutron		1A	1	1.6
	Neutron		3C	25	25.1
*	Neutron Diffusion		2A	12	12.4
*	Neutron Scattering	by Crystals	3A	4	4.6
	Neutron Stars		1C	37	37.4
	Neutrons		1A	2	2.7
*	Newton's First Law of Motion	Inertia	1A	7	7.1
*	Newton's Law of Gravity		1A	8	8.4
*	Newton's Laws of Motion		1A	7	7
*	Newton's Second Law of Motion	Forces Accelerate Masses	1A	7	7.2
*	Newton's Third Law of Motion	Action Begets Reaction	1A	7	7.5
	newtons	Unit of Force, 1 kg-m/sec-squared	1A	7	7.2
	Nodal Plane	Where Electron Atomic Orbit's ψ=0	3C	30	30.3
	Nodal Spherical Surface	Where Electron Atomic Orbit's ψ=0	3C	30	30.2
	Nodes	·	1D	44	44.2
	Noether's Theorem	Symmetry and Conservation Laws	1D	49	49.8
	Non-Inertial reference Frames	,	1A	9	9.9
*	Non-Linear (Slightly) Systems		1D	45	45.8
	Non-Principal Axes		1D	41	41.5
	Normal Vector or Component	Vector Perpendicular to a Surface	2A	1	1.5
*	Nuclear Forces, Strong & Weak	·	1A	9	9.7
*	Nuclear Fusion		3A	9	9.6
*	Nuclear Magnetic Resonance		2D	39	39.7
	Nucleons	Protons or Neutrons	3A	5	5.2
	Nucleus of Atoms		1A	1	1.6
	Nucleus, Radius vs Atomic Number	Fit to Experiment	2A	8	8.5
	Null Experiments		1D	48	48.5
*	Numerical Solution Method		1A	7	7.4
*	Nutation		1D	41	41.4
	_				
	0				
	Ohm's Law of Resistance		1B	13	13.3
	Omega-Minus Particle		1C	37	37.3
	One-Electron Bond		3B	13	13.1
	Open Equation		3A	10	10.3
	Operator Matrices		3A	7	7.7
*	Operator vs. Algebraic Equations		3C	31	31
	Optic axis, of Birefringent		1C	36	36.3
*	Optical Activity		1C	36	36.6
*	Orbit	Conditions for Circular Orbit	1A	8	8.3
	Orbit	of Earth	1A	8	8.5
	Orbit	of Moon	1A	8	8.5
*	Order & Disorder		1B	23	23.6

*	Oscillator Energy & Power		1B	13	13.5
	Oscillator Quality Factor Q	Peak Height-to-Width Ratio	1B	13	13.6
*	Oscillator, Degrees of Damping	Over-, Under- Critically-Damped	1B	14	14.2
*	Oscillators with Damping		1B	13	13.2
*	Oscillators, Forced	with Applied Frequency	1B	12	12.4
	P				
	p-Momentum	p = mv + qA, A is vector potential	3C	33	33.3
	p-n & n-p Junctions	in Semiconductors	3B	20	20.6
*	p-orbit	of Electron in Hydrogen	3C	30	30.3
	p-type Semiconductor	Region with Excess Positive Carriers	3B	20	20.3
	Pappus Centroid Theorem	3	1D	40	40.2
	Parabola	Trajectory with Gravity	1D	39	39.1
	Parabolic Mirror	, ,	1C	31	31.4
	Parallax	to Measure Distance	1A	5	5.3
	Parallel Axis Theorem		1D	40	40.4
*	Parallel Universes Interpretation		3C	34	34.3
*	Paramagnetism		2D	38	38.1
*	Paramagnetism		2D	39	39.5
	Parity	Intrinsic Parity of Particles	1D	49	49.11
	Parity Even or Odd	•	3B	23	23.3
	Parity Violation in Weak Interactions		1D	49	49.11
*	Parity, Reflection Symmetry	P Symmetry	1D	49	49.9
*	Partial Derivative	,	1B	22	22.1
*	Particle Accelerators		1C	37	37.3
*	Particle Accelerators	Electromagnetics of	2B	18	18.3
*	Particle Accelerators	Beam Focusing	2C	30	30.6
*	Particle Exchange Model of Force	3	3B	13	13.5
*	Particle Exchanges Forces (QFT)		3B	24	24.1
*	Particle Motion	in Constant Fields	2C	30	30.1
*	Particle Motion	in Orthogonal Fields	2C	30	30.8
*	Particle Trajectories	in Curved Spacetime Without Forces	2D	46	46.7
	Particle-Wave Duality	•	1C	25	25.5
	Particle-Wave Duality		2D	39	39.1
*	Particle-Wave Duality		3A	1	1.7
*	Particles & Spin	Summary	3A	12	12.2
*	Particles vs. Waves	•	3A	1	1.6
	Passive Circuit Elements		2B	22	22.1
*	Pauli Spin Exchange Operator	Dirac's "Clever Rule"	3B	16	16.6
*	Pauli Spin Matrices		3B	14	14.3
	Pauli Spin Matrices	Products & Operations	3B	14	14.7
*	Pendulums, Coupled Pair	·	1D	43	43.9
*	Periodic Table of Elements		3C	30	30.4
	Perpetual motion machine	First kind	1B	21	21.2
	Perpetual motion machine	Second kind	1B	21	21.3
	Perpetual Motion Machines	Why Impossible	1A	4	4.3

	Perturbation Term		3A	11	11.8
	Phase Shift		1C	31	31.3
*	Phase Space		3A	2	2.2
	Phase Transition		1A	1	1.7
	Phase Velocity	Speed of Single Frequency Wave	1C	34	34.2
*	Phase Velocity	Speed of Single Frequency Wave	1D	43	43.5
	Phase Velocity > Speed of Light		1D	43	43.4
	Phased Array Transmitter		1C	32	32.9
*	Photoelectric Effect	Einstein Solves Mystery	3A	1	1.5
	Photon		3C	25	25.1
*	Photon Polarization States		3B	15	15.5
	Photons		1A	2	2.7
	Photons	Quantum of Light	1B	20	20.5
	Photons		1C	25	25.5
*	Physics	Definition & Goals of	1A	2	2.1
*	Physics, How to Understand It	Feynman's Advice	2A	2	2.1
	Piezoelectricity	PZT	2A	11	11.5
*	Pilot Waves	Bohm Alternative to QM	3C	35	35.3
	Pion		1D	49	49.11
	Pion		3C	25	25.2
	Pion Particle		1C	37	37.3
	Pitch, Musical		1D	45	45.1
	Planck Length	1.6162E-35 meters	1A	5	5.3
	Planck Time	5.3911E-44 seconds	1A	5	5.2
	Planck's constant	6.626E-34 mks	1B	20	20.3
	Planck's equation	Black Body Radiation	1B	20	20.3
	Plane of Incidence	•	1C	36	36.7
*	Plane, Charged	Electric Field Outside	2A	5	5.5
	Plasma	Hot Gas of lons & Free Electrons	1B	15	15.3
	Plasma	State of Ionized Matter	2C	34	34.3
*	Plasma Frequency		2C	32	32.7
	Plasma Frequency	of an Electron Gas	2C	34	34.3
*	Plasma Oscillations		2C	34	34.3
	Pluto	Discovery by Clyde Tombaugh	1A	8	8.7
*	Point Charge	Electric Field Self-Energy Is Wrong	2A	8	8.7
*	Point Charge	Problem of Infinite Self-Energy	2C	29	29.2
	Poisson's Ratio		2D	42	42.1
	Polar Vectors		1D	49	49.10
	Polarization & Linear Superposition		1C	36	36.2
*	Polarization Charges, Dielectric		2A	10	10.3
*	Polarization Tensor		2D	37	37.5
*	Polarization Vector, Dielectric	Uniform in 3-D	2A	10	10.2
*	Polarization Vector, Dielectric	Non-Uniform in 3-D	2A	10	10.4
	Polarized & Unpolarized Light	The state of the s	1C	36	36.1
*	Polarized Light	Classical–Quantum Correspondence	3B	23	23.7
*	Polaroid Filters	Casologi Qualitarii Correspondence	1C	36	36.4
			10	50	оот

*	Polyatomic Molecular Gases	Distribution of kinetic energy	1B	15	15.8
	Population inversion		1B	20	20.6
*	Position Operator in QM		3C	31	31.4
*	Position States, Continuous	Normalization of	3B	22	22.5
	Positive Carriers	Missing Electrons in Crystal	3B	20	20.2
	Positron	Antiparticle of the Electron	3C	27	27.4
*	Positronium Annihilation		3C	27	27.4
*	Potential Energy		1A	10	10.5
*	Power		1A	10	10.2
	Poynting Vector		2C	28	28.2
	Poynting's Theorem		2C	28	28.2
*	Pre-Modern Physics		1A	2	2.2
	Precession		1D	41	41.2
*	Precession, Spin 1/2 Particles		3A	9	9.8
*	Pressure of Gas		1B	15	15.2
*	Pressure of Light		1B	15	15.3
*	Principal Axes		1D	41	41.5
	Principal Planes of Optical System		1C	30	30.8
	Principal Quantum Number		3A	3	3.7
	Principal Quantum Number	of Electron Atomic Orbits	3C	29	29.3
	Principle of Inertia	Discovered by Galileo	1A	7	7.1
*	Principle of Least Action	·	2D	36	36.1
*	Principle of Least Action	Electrostatic Example	2D	36	36.8
	Principle of Least Time	Fermat's Theory of Light Propagation	1C	30	30.3
	Principle of Reciprocity	Reversibility of Light Paths	1C	30	30.4
	Principle of Relativity	Discovered by Galileo	1A	7	7.1
*	Probabilistic Quantum Mechanics	General Principles: #1 — #3	3A	2	2.6
	Probabilistic Quantum Mechanics	General Principles: #1 — #6	3A	4	4.9
*	Probabilistic Quantum Mechanics	General Principles: #1 — #7	3A	12	12.3
	Probability Amplitude		3A	2	2.6
*	Probability Amplitude	Wave Behavior	3A	3	3.1
*	Probability Amplitude		3A	4	4
	Probability Current		3C	32	32.1
*	Probability, Local Conservation		3C	32	32.1
	Projection Effect	Radiation due to Transverse Motion	1C	32	32.2
	Propagation Ratio	of Ladder Network	2B	22	22.8
	Proper Time	or Educati Notwork	1C	27	27.2
	Proper Time		2D	46	46.7
	Proton		1A	1	1.6
	Proton		3C	25	25.1
	Protons		1A	2	2.7
	Pseudovectors		1D	49	49.10
	Pulsars		1C	37	49.10 37.4
	Pure Tone		1D	43	43.3
	Pure Tone		1D 1D	43 45	43.3 45.3
		Llea by Astronomora			45.3 48.4
	Purkinje Effect	Use by Astronomers	1D	48	40.4

	Pyroelectricity		2A	11	11.5	
	Q					
	QED, Quantum Electrodynamics	Theory of Light & Matter	1C	30	30.1	
	Quadrupole Magnets	Theory of Light & Matter	2C	30	30.7	
*	Quantization	What is	3A	1	1.3	
*	Quantization, Why It Exists	What is	2D	39	39.1	
*	Quantized Energy Levels	Derived with Schrödinger's Equation	3B	22	22.7	
*	Quantized Magnetic States	Derived with comodinger a Equation	2D	39	39.2	
*	Quantum Basis States	Similarity to Basis Vectors	3A	10	10.2	
*	Quantum Basis States	Differences from Basis Vectors	3A	10	10.2	
*	Quantum Basis States Quantum Basis States	Summary	3A	12	10.3	
*		Theory of Strong Force	2C	29	29.6	
	Quantum Chromodynamics, QCD	Theory of Strong Force	3C	34	29.6 34.6	
	Quantum Computing Quantum Electrodynamics	QED, Quantum EM w/ Feynman Diag.	3B	13	13.5	
	Quantum Electrodynamics (QED)	QED, Quantum Ew w/ Feynman Diag.	1A	2	2.6	
	Quantum Electrodynamics (QED) Quantum Electrodynamics QED		1B	20	20.5	
*	-	Liltimate Theory of Floatramagnation				
	Quantum Electrodynamics, QED	Ultimate Theory of Electromagnetism	2C	29	29.5 13.5	
*	Quantum Field Theory	QFT	3B	13		
*	Quantum Mechanical Operators Quantum Mechanics	Summary	3A	12	12.5	
*		Change Dut Tave	1A	2	2.6	
*	Quantum Mechanics	Strange But True	3A	1	1.1	
*	Quantum Mechanics	Key Principles	3A	1	1.2	
*	Quantum Mechanics	How QM Began	3A	1	1.4	
	Quantum Mechanics	Philosophical Implications of	3A	3	3.9	
*	Quantum Mechanics	Why Is It So Abstract?	3A	10	10.1	
	Quantum Numbers	Characterize Particle Properties	1D	49	49.13	
	Quantum Numbers of Particles		3C	26	26.1	
	Quantum Operators		3A	10	10.4	
*	Quantum Secure Communication		3C	34	34.9	
*	Quantum States		3A	4	4.1	
	Quarks		1A	2	2.7	
	Quarks		1C	37	37.3	
	Quarks		3C	25	25.1	
	Quarter-Wave Plate		1C	36	36.3	
	Quasiparticle		3B	21	21.2	
	qubit	1 bit of quantum information	3C	34	34.6	
	R					
*	Rabi Experiment		2D	39	39.4	
	Radians		1C	31	31.1	
	Radiation Pressure		1C	37	37.10	
	Radiation Resistance	Antenna Impedance	1C	35	35.1	
*	Radiation, Entropy of	Light Maximizes Entropy / Energy	3A	9	9.9	
*	Radioactive Decay	., 5,	3A	9	9.6	
	Radioisotope Dating		1A	5	5.2	

*	Random Walk	Drunken Sailor Problem	1B	17	17.2
*	Ratchet and Pawl Experiment		1B	23	23.1
	Rayleigh Diffraction Limit		1C	31	31.6
	Rayleigh-Jeans law of radiation		1B	20	20.2
	Real Numbers		1B	12	12.5
	Realism	Reality Exists without Observation	3C	35	35.1
	Recombination	of Free Electrons & Holes	3B	20	20.2
	Rectification, in Nonlinear Systems		1D	45	45.8
*	Rectifiers		3B	20	20.7
	Redshift	of receding light source	1C	37	37.8
	reductio ad absurdum	Proof by Showing Opposite is Absurd	1B	21	21.4
	Reductionism	rear by enaming appears to reserve	3B	14	14.1
*	Reflection / Parity Symmetry		3B	23	23.2
*	Reflection of Light		1C	30	30.2
*	Reflection of Light	Analysis with EM Waves	2C	33	33.4
*	Reflection of Light	from Metals	2C	33	33.7
	Reflection, Total Internal	nom wotalo	1C	31	31.5
*	Refraction	in Dense Matter	2C	32	32
*	Refraction in Metals	III Delise Mattel	2C	32	32.6
*	Refraction of Light		1C	30	30.2
*	Relational QM, Reality & EPR		3C	35	35.9
*	Relational Quantum Mechanics	per Carlo Rovelli	3C	35	35.8
*	Relativity	Impact on Photons	1C	26	26.5
*	Relativity	What's Not Relative	1C	26	26.6
	Relativity, Principle of	What's Not Relative	1C	25	25.2
		of Hystorogic Loop	2D	41	41.9
	Residual Magnetic Field Resistor	of Hysteresis Loop	2D 1B	13	13.3
			2B	22	22.1
*	Resistors, Electrical Resonances		2B 1B	13	13.1
*	Resonant Cavities		2B	23	23.3
*		and C. Cirquita	2B		
	Resonant Cavities Rest Mass	as L-C Circuits	2D 1C	23 26	23.5 26.3
		m_0			
	Retard Time Retarded Distance		2B	21	21.1
			2B	21	21.1
	Retarded Time		1C	32	32.2
*	Reversible Machines		1A	4	4.3
	Reynolds Number	Disht Hand Oissalas Dalariation	2D	45	45.3
	RHC	Right Hand Circular Polarization	1C	36	36.2
	Rich Tone		1D	45	45.3
	Right Hand Rule		1A	9	9.6
	Right Hand Rule		1D	41	41.1
	Right-Hand Rule		1D	49	49.10
	rms, Root-Mean-Square	√ (average of x-squared)	1D	42	42.4
	Root-Mean-Square (rms)	Measure of Deviation from Average	3C	31	31.2
*	Rotation	Rigid Body in 2-D	1D	39	39.2
*	Rotation Matrices, Any Spin		3C	28	28.4

* * * * * * *	Rotation Matrices, Spin 1 & 1/2 Rotation Matrices, Spin 3/2 Rotational Kinetic Energy Rotational Motion Variables Rotations	vs. Linear Motion Variables Rigid Body in 3-D About Z-Axis About Y-axis About X-Axis by Euler Angles for Spin 1/2 For Spin 1/2 For Spin 1 -13.61 eV	3B 3C 1D 1D 1D 3A 3A 3A 3A 3A 3A	17 28 39 41 41 8 8 8 8 8 8	17.5 28.5 39.7 41.7 41.1 8.4 8.5 8.6 8.7 8.8 8.9 3.5
*	s-orbit Saha Equation of Ionization Same Equations, Same Solutions Scalar Potential ø in EM Dynamics	of Electron in Hydrogen	3C 1B 2A 2B	29 18 12 19	29.2 18.3 12.1 19.7
*	Scaling Scanning Electron Microscope SEM Scattering Matrix / S Matrix	of Natural Laws	1D 2C 3A	40 30 10	40.3 30.4 10.6
*	Scattering Operator Schrödinger Eqn. in Magnetic Field Schrödinger's Cat	of Light by Atoms	3C 3C 3C	27 33 34	27.3 33.2 34.3
*	Schrödinger's Equation Schwarzchild Metric Science	Metric Outside a Massive Body Objective & Methods	3B 2D 1A	22 37 1	22.6 37.4 1.1
	Science vs. Mathematics Scientific "Proof" Seismic Wave Seismographs		1A 1A 1D 1D	1 1 46 46	1.4 1.4 46.4 46.4
*	Self-Adjoint Self-Interaction Issues Semiconductors	H = H* and Renormalization	3C 3C 3B	31 26 20	31.1 26.6 20
*	Separation Bubbles Shear Force Shear Modulus		2D 2D 2D	45 42 42	45.4 42.3 42.3
*	Shear Stress Shear Waves Shock Wave	in Solids only	2D 1D 1D	42 46 46	42.3 46.4 46.3
	Short Ocean Waves Side Bands Sidebands, in Nonlinear Systems	Restoring force is surface tension	1D 1D 1D	46 43 45	46.8 43.3 45.8
*	Signal Velocity Silicon Simultaneity	Never Exceeds Speed of Light Semiconductor Not Frame Invariant	1D 3B 1C	43 20 27	43.5 20.1 27.4

	sinc(x)	sin(x) / x	1C	33	33.1
*	Single Particle Equations	Schrödinger and Hamiltonian	3B	24	24.4
	Singlet State	Spin 0	3B	16	16.9
	Singular / Non-singular Matrices	Singular means Det = 0	3B	14	14.6
*	Skin Depth		2C	32	32.7
	Smoke Ring		2D	44	44.7
	Snell's Law of Refraction		1C	30	30.2
*	Solid State Physics	Semiconductors, Hall Effect	3B	24	24.7
	Sound Propagation is Adiabatic		1D	42	42.6
	Space-like Separations		1C	27	27.5
*	Spacetime		1C	27	27.1
*	Special Relativity		1C	25	25.1
*	Special Relativity, Example	Explaining Lorentz Transform in Detail	1C	29	29.1
*	Specific Heat		1B	20	20.1
	Specific Heat at constant Volume		1B	22	22.2
	Specific Heat Ratio		1B	15	15.2
	Specific Viscosity		2D	45	45.1
	Spectrometer, Magnetic		2C	30	30.2
*	Spectrometer, Particle Momentum		2C	30	30.2
*	Speed	Distance/Time in Infinitesimal Limit	1A	6	6.2
*	Speed of Sound, Equation for	343.5 m/s in air @ 20°C, 1 bar	1D	42	42.6
*	Sphere, Charged, Field Inside	No Field Inside	2A	5	5.7
*	Spherical Aberration		1C	30	30.9
	Spherical Harmonics		3C	29	29.4
	Spherical Lens		1C	30	30.5
*	Spin	in Quantum Mechanics	3A	4	4.5
*	Spin	Summary of Key Properties	3A	4	4.9
	Spin	of Massless Particles	3B	23	23.8
*	Spin 0, Invariance in Rotation		3B	17	17.4
*	Spin 1/2 Euler Angle Rotations		3B	17	17.1
*	Spin 1/2 Particle	Hamiltonian in a Magnetic Field	3B	15	15.1
*	Spin 1/2 Particle	Precession in Magnetic Field	3B	15	15.3
*	Spin s, Z-Rotation	for any s	3B	17	17.2
	Spin Statistics, Origin	Why Fermions & Bosons Are Different	3A	8	8.10
*	Spin Transformation Matrices	•	3A	8	8.2
*	Spin Waves		3B	21	21.2
	Spontaneous Emission		1B	20	20.5
	Spontaneous emission	Quantum Mechanics of	3A	6	6.1
	Spontaneous Magnetism		2D	40	40.4
*	Spontaneous Magnetism		2D	41	41.5
	SQUIDs	Supercond. Quan. Interfer. Device	3C	33	33.9
	Staircases vs. Ramps	Quantized vs. Continuous	3A	1	1.3
	Standard Model of Particle Physics		3B	13	13.7
	Standard Model of Particle Physics		3C	26	26.1
	Standing Wave		1D	44	44.3
*	Stationary State	of Definite Energy	3A	9	9.2

*	Statistical Mechanics		1B	16	16.1	
*	Stern-Gerlach Experiment		2D	39	39.3	
*	Stern-Gerlach Spin Analyzer		3A	7	7.2	
	Stimulated Emission		1B	20	20.5	
	Stimulated emission	Quantum Mechanics of	3A	6	6.1	
*	Stokes' Theorem		2A	3	3.6	
	Strain	Fractional Deformation	2D	42	42.1	
*	Strain & Elasticity		2D	37	37.10	
*	Strain in 1-D		2D	42	42.1	
*	Strain in 3-D		2D	42	42.2	
	Strange Quarks		1C	37	37.3	
	Strangeness Quantum Number		3C	26	26.1	
	Stream Tubes		2D	44	44.4	
	Streamlines		2D	44	44.4	
	Stress	Stretching Force / Unit Area	2D	42	42.1	
*	Stress in 1-D	-	2D	43	34.1	
*	Stress Tensor		2D	37	37.9	
*	Stress, Generalized		2D	43	43.2	
	Strong Focusing		2C	30	30.7	
*	Strong Force	Quark-Gluon Model	3B	13	13.7	
	Strong Nuclear Force		1A	2	2.7	
*	Strong Nuclear Force	1960's Models of	2A	8	8.5	
	Successive Approximation		1A	1	1.3	
*	Summing Angular Momenta		3C	28	28.1	
*	Superconductivity		3C	33	33	
	Superfluidity	He-4 Below 2.17K	3A	6	6.3	
	Supermalloy	THE 4 DEIGW 2.17TK	2D	41	41.2	
	Supernova		1C	37	37.4	
	Surface Tension in Short Waves		1D	46	46.8	
	Sweeping Motion at Light Speed	Unique Feynman Analysis Method	1C	37	37.2	
*	Symmetry of Natural Laws	Offique i eyilman Ariarysis Method	1D	49	49.1	
*	Symmetry of Natural Laws	Connection to Conservation Laws	3B	23	23.1	
	Symmetry of Natural Laws	Mechanism of Conservation	3B	23	23.1	
*	Symmetry of Natural Laws	and Conservation Laws	3B	23 24	23.3 24.8	
	,	and Conservation Laws	3Б 1С	37	24.6 37.3	
*	Synchrotron Accelerator		1C	37 37		
	Synchrotron Radiation		10	31	37.4	
	Т					
	Tau-Theta Puzzle		4 D	40	49.12	
			1D	49		
	Taylor Series	for $1/(1+x)$ and $\sqrt{(1+x)}$	1B 2A	23	23.4 6.6	
*	Taylor Series	101 1/(1+x) and \(\frac{1+x}{1+x}\)		6		
	Teleportation, Quantum	About to Thomas dura area	3C	34	34.5	
+	Temperature	Absolute Thermodynamic	1B	21	21.5	
*	Temperature	Equivalence of Definitions	1B	22	22.4	
+	Tempered Intonation, Musical Scale	Dulanaf	1D	45	45.3	
•	Tensor Algebra	Rules of	2D	37	37.3	

*	Tensor Indices		2D	37	37.2
	Tensor Indices	Free Index	2D	37	37.2
	Tensor Indices	Fixed Index	2D	37	37.2
	Tensor Indices	Unmatched Index	2D	37	37.2
	Tensor Indices, Einstein Convention	Sum All Values of Repeated Indices	2D	37	37.2
	Tensor Rank	•	2D	37	37.1
*	Tensors		2D	37	37.1
*	Tensors in Curved Spacetime		2D	37	37.4
	Theory of Everything	per Feynman U = 0	2C	26	26.9
*	Thermal Conductivity	•	1B	19	19.5
*	Thermal Ionization		1B	18	18.3
*	Thermionic Emission		1B	18	18.2
*	Thermodynamics		1B	21	21.1
	Thermodynamics	Two Basic Equations	1B	22	22.2
	Thermodynamics Laws	Statement of 4 Laws	1B	21	21.7
	Thomson Scattering Cross Section	66.5 (fm) ²	1C	35	35.5
	Thought Experiments	,	1C	26	26.1
*	Thunderstorms		2A	9	9.4
*	Tidal Bores		1D	46	46.5
*	Tides, on Earth		1A	8	8.6
	Time	Scale Spans 62 digits	1A	5	5.2
*	Time	Time is what a Clock Measures	1A	5	5.2
*	Time Dependence	of Operators & Measurements	3C	31	31.9
*	Time Dilation	·	1C	26	26.1
*	Time Dilation in Curved Spacetime	Time Runs Slower in Stronger Gravity	2D	46	46.5
*	Time Evolution of States	Ç	3A	10	10.5
	Time Reversal Asymmetry	Evident at Macroscopic Scales	1B	23	23.5
*	Time Reversal Symmetry	Valid at Microscopic Scales	1B	23	23.4
*	Time Reversal Symmetry	T Symmetry	1D	49	49.7
	Time-like Separations	•	1C	27	27.5
	Tone Quality, Musical		1D	45	45.1
*	Torque		1D	39	39.3
*	Torsion	Twisting Shear	2D	42	42.4
*	Torsion Shear Waves	3	2D	42	42.5
*	Total Internal Reflection		2C	33	33.8
*	Transformer, Electromagnetic		2B	17	17.3
*	Transformers		2D	41	41.3
*	Transients		1B	14	14.1
*	Transistor	p-n-p type	3B	20	20.8
*	Translation Symmetry, Spacetime		1D	49	49.2
*	Transmission Lines		2B	22	22.10
	Transverse Shear Waves		2D	42	42.5
	Transverse Waves	in Solids only	1D	46	46.4
*	Trigonometric Formulas	Sum & Products of Sin & Cos	1C	32	32.10
	Triplet State	Spin 1	3B	16	16.9
	21-cm Line	Hydrogen Ground Hyperfine Split	3B	16	16.7

	Twin Paradox		1C	28	28.4
	Twisted Pairs		2C	25	25.1
	Two-Electron Bond		3B	13	13.8
	Two-Slit Experiment		1C	31	31.3
	Two-Slit Experiment		2D	39	39.1
*	Two-Slit Experiment	with Classical Particles	3A	1	1.8
*	Two-Slit Experiment	with Classical Waves	3A	1	1.9
*	Two-Slit Experiment	with Electrons	3A	1	1.10
	Two-Slit Experiment	with Spy Light	3A	2	2.3
*	Two-State Systems	Ammonia Molecule	3A	10	10.8
*	Two-State Systems	Summary	3A	12	12.6
*	Types of Magnetism	,	2D	38	38.1
	U				
	Ultraviolet Catastrophe		1B	20	20.2
	Ultraviolet Catastrophe		3A	1	1.4
	Uncertainty Principle		1A	2	2.6
	Uncertainty Principle	Predictability Not Analysis of Past	3A	3	3.2
	Unification	by Einstein	1A	2	2.1
	Unification	by Ellistelli	1A 1A	2	2.6
			2C	31	31.1
	Unit Cell, of a Crystal Unit Cube	of Diamond Crystal	3B	20	20.1
		of Diamond Crystal			
	Unitarity Principle	Conservation of Probability	3A	10	10.7
	Unitary Operations	Modification without Disruption	3C	34	34.6
	Universality of Natural Laws	Einstein	1C	25	25.5
	V				
	Vacuum Permeability	mu-zero	2B	19	19.5
	Vacuum Permittivity	epsilon-zero	2B	19	19.5
	Vacuum Tubes		2B	22	22.11
	Valence Electrons		1B	18	18.2
*	Van Der Waals Force		3B	13	13.3
	Vapor Pressure		1B	22	22.5
*	Variational Calculus		2D	36	36.3
*	Vector Algebra Pitfalls		2A	2	2.9
	Vector field		1A	10	10.5
*	Vector Field, Curl of		2A	3	3.5
*	Vector Field, Divergence of	Divergence = Outward Flux	2A	3	3.2
*	Vector Field, Flux of	Outward Flux = Divergence	2A	3	3.2
*	Vector Fields	-	1C	32	32.3
	Vector Fields	Definition	2A	1	1.4
*	Vector Fields	Divergence and Curl	2A	1	1.5
*	Vector Potential	of Current J	2B	15	15.2
*	Vector Potential	of Wire	2B	15	15.3
*	Vector Potential	of Solenoid	2B	15	15.4
*	Vector Potential	of Rotating Cylindrical Shell	2B	15	15.6
			- -		

*	Vector Potential A	B = curl of A	2B	15	15.1
	Vector Potential A in EM Dynamics		2B	19	19.7
*	Vectors		1A	6	6.6
	Velocity	Definition	1A	6	6.6
*	Velocity Distribution	of Gas Molecules	1B	16	16.4
	Velocity Operator in QM		3C	33	33.3
	Velocity, Absolute	No physical significance	1C	25	25.2
	Venturi Effect		2D	44	44.5
	Virial Theorem	U = -2T in bound stable systems	3A	3	3.5
	Virtual Image		1C	30	30.5
	Virtual Particles		3B	13	13.5
	Virtual Source		1C	30	30.5
*	Viscosity of Fluids		2D	44	44.1
	Viscosity, Measuring		2D	45	45.1
*	Viscous Flow		2D	45	45.2
*	Vision, Human		1D	48	48
	Voltage		1B	13	13.3
*	Voltage Sources		2B	22	22.2
	Volume Strain		2D	42	42.2
	Volume Stress		2D	42	42.2
*	Vortex Lines		2D	44	44.7
	W				
	W Boson		3C	25	25.1
	W Bosons		1A	2	2.7
	Wall Energy	of Magnetic Domain	2D	41	41.8
*	Water, "Dry" Flow	gg.	2A	12	12.5
	watts	Unit of Power, 1 joule/sec	1A	10	10.3
*	Wave Equation of Sound		1D	42	42.4
*	Wave Function	Philosophical Meaning	3C	32	32.2
*	Wave Functions		3B	22	22.3
	Wave Functions	Coordinate Representation	3B	22	22.6
	Wave Mode Quantization	o con a mano y copi documento.	2D	39	39.1
*	Wave Number	In 1, 3 & 4 dimensions	1C	37	37.6
*	Wave Packet	,	1D	43	43.6
*	Wave Packets		3A	2	2.1
*	Wave Reflection		1D	44	44.1
	Wave Terminology	Amplitude, Period, Freq. & Phase Shift	1B	12	12.2
	Wave Zone	, anjundad, r dried, r req. d. r rided crime	1C	32	32.2
	Wavefront		1D	42	42.3
	Wavefunction Collapse		3C	31	31.2
*	Wavefunction Collapse		3C	34	34.1
*	Waveguides	Speed of Waves in	2C	25	25.4
*	Waveguides	Plumbing of	2C	25	25.6
*	Waveguides	Modes in	2C	25	25.7
*	Waveguides	Feynman's Insight on Cutoff Freq.	2C	25	25.8
		. Symmetre moight on outon ricq.	_0	_0	20.0

*	Waveguides, Rectangular		2C	25	25.2
	Wavelength		1C	31	31.1
	Weak Focusing		2C	30	30.7
	Weak Nuclear Force		1A	2	2.7
	Weight vs. Mass		1A	7	7.2
*	Why do We See Clouds?		1C	35	35.5
*	Why is the Sky Blue?		1C	35	35.5
*	Why is the Sunset Red?		1C	35	35.5
*	Wire, Charged	Electric Field Outside	2A	5	5.4
*	Wires & Cables	as Transmission Lines	2C	25	25.1
*	Work	A Form of Energy	1A	10	10.3
	Work Function, of Metal	Energy Needed to Remove Electron	1B	18	18.2
	Work Hardening	of Metal Crystals	2C	31	31.7
*	World Lines		1C	28	28.5
	X				
*	X-ray Crystallography		1C	33	33.6
*	X-ray Crystallography	Finding Lattice Type & Unit Cell	3A	3	3.4
	A-ray Crystallography	Finding Lattice Type & Onit Cell	3A	3	3.4
	Υ				
	Yoke, Magnetic		2B	17	17.2
	Young's Modulus		2D	42	42.1
*	Yukawa Meson Exchange Model		3B	13	13.6
	7				
	Z				
	Z Boson	Mass Width	1B	13	13.4
	Z Boson		3C	25	25.1
	Z Bosons		1A	2	2.7
	Zeeman Splitting		3B	16	16.8
	Zeno's Paradox		1A	6	6.2
	Zero-point energy		1B	20	20.3

END INDEX FILE