Physics with Lab

Week	Kahn Academy		Classical Physics		Physics for the 21st Century and Mechanical Universe	
	Set up your Kahn Academy Exercise Software for added practice at this link. Lesson Titles are Below		*A complete course in Physics including video lectures, assignments, exams, and solutions.*		*Weeks 1 - 12: Comprehensive Units and Weeks 13 - 26: 2 or 3 Lessons a Week - See Titles Below*	
1	Lessons 1 - 2		Lecture 1, Powers of Ten - Units - Dimensions - Measurements - Uncertainties - Dimensional Analysis - Scaling Arguments		Introduction to the Online Text	
2	Lessons 3 - 4		Lecture 2, 1D Kinematics - Speed - Velocity - Acceleration		Unit 1: The Basic Building Blocks of Matter	
3	Lessons 5 - 6		Lecture 3, Vectors - Dot Products - Cross Products - 3D Kinematics		Unit 2: The Fundamental Interactions	
4	Lessons 7 - 8		Lecture 4, 3D Kinematics - Free Falling Reference Frames Assignment 1 due		Unit 3: Gravity	
5	Lesson 9 - 10		Lecture 5, Circular Motion - Centrifuges Moving - Reference Frames - Perceived Gravity		Unit 4: String Theory and Extra Dimensions	

6	Lesson 11 - 12		Lecture 6, Newton's Laws	-	Unit 5: The Quantum World	
7	Lesson 13 - 14		Lecture 7, Weight - Perceived Gravity - Weightlessness Free Fall - Zero Gravity in Orbit (Misnomer)	-	Unit 6: Macroscopic Quantum Mechanics	
8	Lesson 15 - 16		Lecture 8, Friction Assignment 2 due	-	Unit 7: Manipulating Light	
9	Lessons 17 - 18		Lecture 9, Exam Review and Exam 1	-	Unit 8: Emergent Behavior in Quantum Matter	
10	Lessons 19 - 20		Lecture 10, Hooke's Law - Springs - Simple Harmonic Motion - Pendulum - Small Angle Approximation	-	Unit 9: Biophysics	
11	Lessons 21 - 22		Lecture 11, Work - Kinetic Energy - Potential Energy - Conservative Forces - Conservation of Mechanical Energy - Newton's Universal Law of Gravitation	-	Unit 10: Dark Matter	
12	Lessons 23 - 24		Lecture 12, Non-Conservative Forces - Resistive Forces - Air Drag - Terminal Velocity Assignment 3 due	-	Unit 11: Dark Energy	
13	Lessons 25 - 26		Lecture 13, Potential Energy - Energy Considerations to Derive Simple Harmonic Motion	-	Lessons 1 - 3	

14	Lessons 27 - 28		Lecture 14, Escape Velocities - Bound and Unbound Orbits - Circular Orbits - Various Forms of Energy - Power	-	Lessons 4 - 6	
15	Lessons 29 - 30		Lecture 15, Momentum - Conservation of Momentum - Center of Mass Assignment 4 due	-	Lessons 7 -9	
16	Lessons 31 - 32		Lecture 16, Collisions - Elastic and Inelastic - Center of Mass Frame of Reference	-	Lessons 10 - 12	
17	Lessons 33 - 34		Lecture 17, Impulse - Rockets	-	Lesson 13 - 14	
18	Lessons 35 - 36		Lecture 18, Exam Review Assignment 5 due and Exam 2	-	Lesson 15 - 16	
19	Lessons 37 - 38		Lecture 19, Rotating Rigid Bodies - Moment of Inertia - Parallel Axis and Perpendicular Axis Theorem - Rotational Kinetic Energy - Fly Wheels - Neutron Stars - Pulsars	-	Lessons 17 - 18	
20	Lessons 39 - 40		Lecture 20, Angular Momentum - Torques - Conservation of Angular Momentum - Spinning Neutron Stars - Stellar Collapse	-	Lessons 19 - 20	

21	Lessons 41 - 42		Lecture 21, Torques - Oscillating Bodies - Hoops Assignment 6 due		Lessons 21 - 22	
22	Lessons 43 - 44		Lecture 22, Kepler's Laws - Elliptical Orbits - Satellites - Change of Orbits - Ham Sandwich		Lessons 23 - 24	
23	Lessons 45 - 46		Lecture 23, Doppler Effect - Binary Stars - Neutron Stars and Black Holes		Lessons 25 - 26	
24	Lessons 47 - 48		Lecture 24, Rolling Motion - Gyroscopes - Very Non-intuitive Assignment 7 due		Lessons 27 - 28	
25	Lessons 49 - 50		Lecture 25, Static Equilibrium - Stability - Rope Walker		Lessons 29 - 30	
26	Lessons 51 - 52		Lecture 26, Elasticity - Young's Modulus		Lessons 31 - 32	
27	Lessons 53- 54		Lecture 27, Fluid Mechanics - Pascal's Principle - Hydrostatics - Atmospheric Pressure - Over Pressure in Lungs and Tires		Lessons 33 - 34	

28	Lessons 55 - 56		Lecture 28, Hydrostatics - Archimedes' Principle - Fluid Dynamics - What Makes Your Boat Float? - Bernoulli's Equation Assignment 8 due		Lessons 35 - 36	
29	Lessons 57 -58		Lecture 29, Exam Review		Lessons 37 - 38	
30	Lessons 59 - 60		Exam 3		Lessons 39 - 40	
31	Lessons 61 - 62		Lecture 30, Simple Harmonic Oscillations - Energy Considerations - Torsional Pendulum		Lessons 41 - 42	
32	Lessons 63 - 64		Lecture 31, Forced Oscillations - Normal Modes - Resonance - Natural Frequencies - Musical Instruments		Lessons 43 - 44	
33	Lessons 65 - 66		Lecture 32, Heat - Thermal Expansion Assignment 9 due		Lessons 45 - 46	
34	Lesson 67		Lecture 33, Kinetic Gas Theory - Ideal Gas Law - Isothermal Atmosphere - Phase Diagrams - Phase Transitions and Final Exam		Lessons 47 - 48	

35			Lecture 34, The Wonderful Quantum World - Breakdown of Classical Mechanics	-	Lessons 49 - 51	
36			Lecture 35, Farewell Special - High-energy Astrophysics	-	Lesson 52	

Kahn Academy	Mechanical Universe and Beyond
1. Statistics: The Average	1. Introduction
2. Statistics: Sample vs. Population Mean	2. The Law of Falling Bodies
3. Statistics: Variance of a Population	3. Derivatives
4. Statistics: Sample Variance	4. Inertia
5. Statistics: Standard Deviation	5. Vectors

6. Statistics: Alternate Variance Formulas	6. Newton's Laws
7. Introduction to Random Variables	7. Integration
8. Probability Density Functions	8. The Apple and the Moon
9. Binomial Distribution 1	9. Moving in Circles
10. Binomial Distribution 2	10. Fundamental Forces
11. Binomial Distribution 3	11. Gravity, Electricity, Magnetism
12. Binomial Distribution 4	12. The Millikan Experiment
13. Expected Value: E(X)	13. Conservation of Energy

14. Expected Value of Binomial Distribution	14. Potential Energy
15. Poisson Process 1	15. Conservation of Momentum
16. Poisson Process 2	16. Harmonic Motion
17. Law of Large Numbers	17. Resonance
18. Normal Distribution Excel Exercise	18. Waves
19. Introduction to the Normal Distribution	19. Angular Momentum

20. ck12.org Normal Distribution Problems: Qualitative sense of normal distributions	20. Torques and Gyroscopes
21. ck12.org Normal Distribution Problems: z-score	21. Kepler's Three Laws
22. ck12.org Normal Distribution Problems: Empirical Rule	22. The Kepler Problem
23. ck12.org Exercise: Standard Normal Distribution and the Empirical Rule	23. Energy and Eccentricity
24. ck12.org: More Empirical Rule and Z-score practice	24. Navigating in Space
25. Central Limit Theorem	25. Kepler to Einstein
26. Sampling Distribution of the Sample Mean	26. Harmony of the Spheres
27. Sampling Distribution of the Sample Mean 2	27. Beyond the Mechanical Universe

28. Standard Error of the Mean	28. Static Electricity
29. Sampling Distribution Example Problem	29. The Electric Field
30. Confidence Interval 1	30. Potential and Capacitance
31. Mean and Variance of Bernoulli Distribution Example	31. Voltage, Energy, and Force
32. Bernoulli Distribution Mean and Variance Formulas	32. The Electric Battery

33. Margin of Error 1	33. Electric Circuits
34. Margin of Error 2	34. Magnetism
35. Confidence Interval Example	35. The Magnetic Field
36. Small Sample Size Confidence Intervals	36. Vector Fields and Hydrodynamics
37. Hypothesis Testing and P-values	37. Electromagnetic Induction
38. One-Tailed and Two-Tailed Tests	38. Alternating Current
39. Z-statistics vs. T-statistics	39. Maxwell's Equations
40. Type 1 Errors	40. Optics

41. Small Sample Hypothesis Test	41. The Michelson-Morley Experiment
42. T-Statistic Confidence Interval	42. The Lorentz Transformation
43. Large Sample Proportion Hypothesis Testing	43. Velocity and Time
44. Variance of Differences of Random Variables	44. Mass, Momentum, Energy
45. Difference of Sample Means Distribution	45. Temperature and Gas Laws
46. Confidence Interval of Difference of Means	46. Engine of Nature
47. Clarification of Confidence Interval of Difference of Means	47. Entropy
48. Hypothesis Test for Difference of Means	48. Low Temperatures

49. Comparing Population Proportions 1	49. The Atom
50. Comparing Population Proportions 2	50. Particles and Waves
51. Hypothesis Test Comparing Population Proportions	51. From Atoms to Quarks
52. Squared Error of Regression Line	52. The Quantum Mechanical Universe
53. Proof (Part 1) Minimizing Squared Error to Regression Line	
54. Proof (Part 3) Minimizing Squared Error to Regression Line	
55. Proof (Part 4) Minimizing Squared Error to Regression Line	

56. Regression Line Example
57. Proof Part 2 Minimizing Squared Error to Line
58. R-Squared or Coefficient of Determination
59. Second Regression Example
60. Calculating R-Squared
61. Covariance and the Regression Line
62. Chi-Square Distribution Introduction
63. Pearson's Chi Square Test (Goodness of Fit)

64. Contingency Table Chi-Square Test
65. ANOVA 1 - Calculating SST (Total Sum of Squares)
66. ANOVA 2 - Calculating SSW and SSB (Total Sum of Squares Within and Between).avi
67. ANOVA 3 - Hypothesis Test with F-Statistic