

Index

- acceleration, 8, 11, 44, 45, 48, 88, 98, 101, 106, 107, 109, 110, 113, 118, 137, 138, 149, 291, 311, 534
- accuracy, 50, 51, 53, 96
- adiabatic, 268, 271, 282
- air, 237, 238
- alpha decay, 20, 582, 585
- alpha particle, 304, 585, 587, 603
- Amontons' Law, 239, 241
- amplitude, 17, 436, 438, 439, 441, 450, 470, 568
- angle of incidence, 18, 471, 483, 484, 488, 508
- angle of reflection, 483, 488
- assumptions, 65, 97, 98, 99, 169, 530
- atom, 121, 591, 592, 599
- band of stability, 584, 585, 586
- base, 117, 118
- battery, 13, 296, 321, 324, 326, 329, 331, 335, 340, 341, 342, 343, 344, 346, 347, 350, 352, 360, 363, 376, 377, 381, 382, 397, 398, 399, 416
- electromotive force, 326, 340, 417, 426
- internal resistance, 13, 324, 341, 342
- beta decay, 20, 582
- beta minus, 585
- beta plus, 586
- beta particle, 587
- bimetal strip, 223, 225
- binding energy, 591, 592
- Bohr model, 556, 564
- boiling, 207, 211, 600
- boiling point, 211
- boson, 573, 574
- buoyancy, 164
- calorimeter, 60
- calorimetry, 196, 198, 199, 208
- capacitance, 12, 323, 328, 380, 382, 384, 385, 386, 387, 393, 394, 395, 396, 398, 399, 400
- capacitor, 147, 296, 322, 335, 347, 380, 381, 382, 383, 384, 385, 386, 389, 393, 394, 395, 396, 397, 398, 399, 400, 401, 605
- center of mass, 98
- centripetal force, 428
- cgs, 122
- charge, 9, 10, 11, 12, 13, 15, 16, 19, 20, 101, 121, 136, 184, 230, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 307, 308, 310, 313, 314, 316, 317, 323, 324, 326, 328, 331, 335, 336, 348, 380, 381, 382, 383, 384, 385, 386, 390, 393, 394, 395, 396, 397, 398, 399, 400, 401, 404, 410, 415, 428, 561, 562, 570, 571, 572, 574, 575, 576, 579, 582, 585, 605
- chemical reaction, 60, 234
- circuit, 8, 12, 13, 108, 110, 299, 321, 322, 323, 324, 325, 326, 327, 329, 331, 332, 334, 335, 336, 337, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 360, 361, 362, 365, 366, 367, 368, 369, 370, 371, 373, 375, 376, 377, 378, 379, 380, 381, 386, 387, 388, 389, 391, 392, 393, 394, 395, 396, 397, 398, 399, 415, 423, 426, 603
- parallel, 8, 359, 360, 361, 362, 368, 369, 377, 385
- series, 353, 354, 355, 356, 361, 362, 363, 378, 386
- coefficient of thermal expansion, 221
- collision, 8, 20, 98, 234, 248, 249, 252, 555
- elastic, 20, 98, 186, 234, 237, 248, 555
- inelastic, 20, 98, 248, 249, 555
- color, 472, 476, 478, 479, 480, 504, 526, 529, 571, 572, 576
- combination, 23, 31, 118
- combined gas law, 237, 239, 240, 244
- compound, 123
- concave, 469, 484, 486, 489, 492, 493, 494, 495, 509, 515, 517, 520, 522
- conduction, 11, 15, 190, 192, 195, 231, 292
- conductivity, 190, 191, 192, 328, 341, 424
- conductor, 14, 191, 296, 299, 325, 404
- contract, 98, 220, 222, 223, 516, 517
- convection, 15, 190, 191, 231, 281, 410
- convex, 469, 484, 486, 488, 491, 496, 509, 513, 514, 517, 519, 521
- Cornell Notes, 22
- crest, 431, 436
- current, 8, 9, 13, 14, 108, 110, 118, 296, 300, 321, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 335, 336, 340, 341, 342, 343, 344, 348, 349, 350, 351, 352, 353, 354, 355, 356, 359, 360, 361, 362, 363, 368, 369, 371, 372, 376, 377, 378, 379, 380, 393, 394, 395, 396, 397, 400, 401, 403, 404, 405, 414, 415, 416, 417, 420, 421, 422, 423, 424, 425, 426, 427, 541, 601, 605
- alternating, 327, 329
- direct, 329
- density, 62
- diamagnetic, 408
- diffraction, 8, 17, 18, 20, 430, 470, 471, 472, 523, 524, 525, 526, 554, 556
- diffraction grating, 523, 524, 525, 526
- diode, 335
- light-emitting, 285, 335
- light-emitting (LED), 285, 333, 335, 557

- direction, 3, 9, 10, 13, 14, 15, 17, 42, 50, 52, 95, 117, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 179, 184, 188, 191, 230, 289, 290, 296, 301, 304, 305, 306, 307, 311, 312, 313, 317, 319, 320, 324, 325, 329, 335, 350, 351, 352, 376, 377, 379, 393, 404, 405, 409, 415, 417, 419, 420, 424, 428, 434, 465, 470, 481, 483, 497, 502, 507, 508, 509, 510, 511, 512, 528, 534, 538, 578, 605
- displace, 163, 168, 171
- displacement, 10, 45, 47, 62, 75, 137, 138, 140, 142, 290, 309, 436, 439, 442, 449
- distance, 15, 19, 35, 45, 47, 53, 63, 73, 75, 86, 101, 112, 117, 118, 140, 145, 156, 175, 224, 230, 253, 260, 300, 301, 302, 303, 304, 381, 384, 413, 415, 417, 436, 439, 449, 480, 481, 482, 484, 485, 487, 490, 491, 492, 493, 494, 495, 496, 509, 511, 519, 520, 521, 522, 524, 527, 544, 546, 547, 548, 554, 569, 584, 587, 605
- Doppler, 429, 430, 462, 463, 464, 467
- efficiency, 184, 232, 259, 284, 285, 286, 287
- electric field, 8, 9, 10, 11, 288, 289, 290, 292, 293, 305, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 322, 384, 403, 409, 414, 415, 418, 423, 473, 541, 605
- electric potential, 5, 10, 13, 290, 310, 316, 317, 320, 323, 325, 326, 336, 344, 348, 352, 354, 376, 394, 571, 605
- electricity
static electricity, 295
- electromagnet, 414, 422, 423, 424, 601
- electron, 19, 20, 21, 294, 295, 300, 301, 304, 307, 312, 320, 340, 407, 554, 556, 557, 558, 562, 564, 565, 566, 567, 568, 571, 572, 578, 579, 580, 583, 585, 586, 588, 589, 591, 605
- electron capture, 583, 586, 588
- element, 22
- energy, 8, 12, 13, 15, 17, 18, 19, 20, 21, 98, 108, 109, 110, 111, 112, 122, 136, 156, 183, 184, 186, 187, 188, 189, 190, 193, 197, 202, 204, 209, 210, 211, 213, 219, 229, 230, 231, 232, 233, 237, 248, 249, 251, 253, 254, 256, 259, 260, 261, 262, 263, 267, 269, 276, 279, 280, 281, 283, 284, 285, 286, 288, 289, 292, 296, 297, 310, 322, 323, 326, 328, 333, 344, 354, 383, 390, 403, 407, 413, 432, 435, 459, 470, 471, 472, 474, 531, 541, 552, 554, 555, 556, 557, 558, 560, 561, 563, 564, 566, 569, 570, 571, 573, 574, 576, 581, 587, 591, 592, 599, 601, 602
- conservation of energy, 8, 12, 13, 15, 17, 19, 20, 150, 156, 231, 248, 249, 251, 256, 260, 280, 292, 323, 555
- kinetic, 15, 20, 110, 111, 175, 178, 186, 187, 189, 202, 230, 235, 248, 249, 251, 252, 253, 261, 552, 555, 557, 558, 560
- potential, 8, 10, 15, 108, 178, 188, 202, 230, 248, 251, 256, 259, 290, 309, 310, 326, 354, 385
- enthalpy, 254, 261
- entropy, 16, 184, 232, 251, 254, 259, 260, 261, 267, 284
- expand, 44, 45, 98, 191, 197, 209, 212, 220, 222, 223, 248, 281, 500
- fermion, 573, 574
- ferromagnetic, 14, 404, 408, 423, 426
- Feynman diagram, 577, 578
- fission, 8, 20, 581, 582, 599, 600
- fluid, 204
- focal point, 469, 484, 487, 509, 516, 517
- focus, 112, 484, 487, 488, 489, 490, 491, 497, 509, 511, 512, 514, 515, 516, 517
- force, 4, 8, 9, 10, 11, 14, 15, 16, 17, 19, 28, 44, 45, 47, 48, 75, 103, 104, 106, 107, 109, 110, 113, 114, 115, 118, 122, 129, 130, 140, 142, 149, 150, 151, 152, 155, 156, 157, 158, 159, 163, 164, 165, 166, 167, 168, 170, 175, 191, 230, 231, 235, 238, 239, 248, 253, 288, 289, 291, 294, 297, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 311, 312, 313, 320, 326, 340, 397, 404, 405, 407, 409, 410, 414, 415, 416, 418, 419, 420, 422, 424, 425, 426, 428, 456, 534, 553, 554, 564, 569, 572, 575, 584, 585, 591
- contact force, 16, 17, 150
- net force, 28, 44, 149, 165, 166, 167, 304, 312, 407, 418, 534
- normal force, 8, 103, 110, 167
- formula, 54
- free-body diagram, 8, 11, 14, 103, 163, 291, 404
- frequency, 17, 19, 21, 109, 121, 327, 329, 429, 430, 431, 436, 437, 438, 439, 442, 443, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 462, 463, 464, 465, 470, 473, 474, 476, 553, 555, 556, 557, 558, 559, 561, 563, 565
- friction, 8, 11, 17, 44, 47, 86, 97, 98, 99, 103, 110, 150, 264, 292
- kinetic, 110
- fundamental forces, 569, 572
- fuse, 334, 336, 360, 601
- fusion, 8, 20, 203, 204, 205, 213, 214, 581, 582, 599, 601
- gamma ray, 587, 602
- gas, 16, 111, 197, 203, 204, 206, 208, 209, 211, 212, 213, 215, 216, 217, 219, 226, 227, 229, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 251, 253, 257, 264, 266, 267, 268, 269, 272, 273, 274, 275, 276, 278, 279, 280, 281, 282, 283, 285, 286, 432, 605
- gas constant, 245
- generator, 14, 285, 294, 296, 300, 405, 425, 446
- gluon, 576, 578
- gravity, 8, 98, 103, 104, 108, 132, 158, 159, 167, 191, 310, 547, 548, 569, 605
- hadron, 576
- half-life, 396, 593, 594, 595, 596, 597, 603
- harmonic series, 453
- heat, 8, 15, 60, 98, 101, 183, 184, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 209, 210, 212, 213, 214, 215, 216, 217, 218, 219, 220, 229, 231, 232, 233, 235, 238, 248, 249, 251, 252, 253, 254, 255, 256, 257, 259, 260, 261, 262, 263, 264, 266, 267, 268, 269, 270, 271, 272, 279, 280, 281, 282, 283, 284, 285, 286, 287, 592, 600, 601
- heat of fusion, 184, 212, 213, 214
- heat of vaporization, 213, 215
- heat transfer, 184, 190, 192, 196, 233, 255, 260, 263, 271, 286

- heating curve, 203, 208, 210, 212, 214, 215, 217, 218, 219, 220
- Helmholtz, 261, 446, 452
- Higgs boson, 573
- hydrostatic, 158, 159, 164, 165, 176, 177, 178
- ideal gas law, 16, 232, 236, 244, 245, 246, 247
- image
 - inverted, 490, 510
 - real, 481, 484, 490, 497, 509, 510, 511
 - upright, 510
 - virtual, 481, 484, 489, 490, 491, 497, 509, 510, 511, 518
- impulse, 8
- induction, 11, 12, 292, 297, 415
- inductor, 336, 414, 422, 426, 427
- insulator, 191, 296, 381, 384
- interference, 8, 18, 20, 441, 444, 445, 450, 455, 470, 472, 524, 554, 556
- isobaric (constant pressure), 268, 272, 274
- isochoric (constant volume), 268, 269, 274
- isothermal (constant temperature), 268, 270, 282
- isotope, 603
- Kelvin, 118, 193, 195, 226, 235, 240, 242, 244, 245, 247
- kinetic energy, 235
- laws of thermodynamics, 254
- length contraction, 531, 547, 552
- lens, 112, 469, 497, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522
 - principal axis, 484, 487, 488, 510
 - vertex, 510, 511, 512, 578
- lepton, 572
- lift, 156, 157, 161, 169, 170, 179
- liquid, 186, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 216, 219, 220, 226, 233, 234, 246, 281, 286, 384, 411, 432, 601
- logarithm, 95, 144, 145, 146, 147, 459, 596
- magnet, 14, 380, 393, 404, 406, 407, 408, 409, 412, 414, 415, 422, 423
- magnetic field, 8, 9, 13, 14, 17, 142, 289, 327, 403, 404, 405, 407, 408, 409, 410, 411, 413, 414, 415, 416, 417, 418, 419, 420, 422, 423, 424, 425, 426, 428, 470, 473, 541, 571, 601
- magnetic permeability, 408, 417, 423, 424, 542
- magnetism, 288, 321, 403, 407, 410, 432, 571
- magnification, 490, 511
- magnitude, 9, 10, 11, 14, 48, 65, 129, 130, 131, 134, 135, 136, 139, 140, 141, 142, 143, 289, 290, 292, 295, 303, 304, 305, 306, 311, 319, 320, 404, 415, 419, 524, 538, 571, 605
- mass defect, 591, 592
- mass spectrometer, 418, 422, 428
- matter, 35, 208
- medium, 2, 8, 17, 18, 296, 297, 429, 431, 432, 433, 436, 437, 440, 442, 446, 455, 466, 470, 471, 472, 473, 478, 497, 498, 499, 500, 505, 528, 529, 543
- melt, 205, 601
- metal, 62, 603
- metric system, 117, 118, 119
 - cgs, 122
 - MKS, 122, 235, 327
- mirror, 88, 112, 469, 481, 482, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 500, 509, 511, 546, 547
- MKS, 122, 327
- molecule, 208, 211
- momentum, 8, 12, 15, 17, 20, 39, 101, 107, 108, 112, 184, 186, 187, 190, 230, 233, 237, 249, 260, 292, 530, 551, 552, 555, 556, 565
- motor, 285, 296, 414, 422, 424
- musical instrument
 - strings, 447, 449, 456
 - winds, 448, 451
- nearsightedness, 517
- neutralize, 603
- neutrino, 574
- neutron, 591, 599
- nuclear, 591, 600, 601, 602
- nucleus, 591, 599
- paramagnetic, 408
- pendulum, 294
- percent error, 54
- period, 17, 21, 94, 110, 118, 123, 294, 431, 436, 438, 470, 582, 594
- permeability, 408, 423, 424, 542, 605
- permittivity, 384, 408, 542, 562, 605
- phase change, 183, 203, 208, 209, 212, 213, 281
- photoelectric effect, 8, 20, 554, 555, 556, 557, 558
- photon, 20, 21, 109, 111, 112, 542, 544, 555, 556, 578, 579, 580
- physical, 208
- pigment, 479
- pitch, 429, 446, 447, 448, 452, 453, 456, 457, 465
- plasma, 209, 212, 601
- polarization, 9, 289, 472, 507, 508
- polarized light, 9, 289, 472, 507, 508
- position, 17, 45, 137, 188, 266, 289, 322, 397, 403, 408, 432, 470, 480, 532
- positive charge, 603
- potentiometer, 335
- power, 13, 101, 102, 108, 114, 119, 125, 126, 136, 192, 193, 283, 285, 286, 324, 325, 326, 328, 329, 330, 331, 332, 333, 337, 340, 341, 343, 344, 353, 354, 355, 356, 359, 360, 361, 362, 363, 368, 369, 371, 372, 380, 381, 385, 393, 422, 434, 459, 587, 595, 597, 602
- precision, 50, 51, 53, 56, 57, 61, 65, 70, 96
- pressure, 15, 16, 17, 98, 101, 109, 111, 120, 149, 150, 151, 152, 153, 154, 155, 156, 158, 159, 160, 161, 163, 164, 165, 173, 175, 176, 177, 178, 179, 180, 182, 183, 197, 203, 204, 205, 206, 207, 226, 229, 231, 232, 233, 235, 236, 237, 238, 239, 241, 242, 243, 245, 246, 247, 248, 262, 263, 264, 266, 267, 268, 269, 270, 272, 274, 275, 280, 361, 432, 448, 449, 451, 457, 468, 600, 605
- absolute, 152

- gauge, 152, 235
hydraulic, 155, 156
primary color, 479, 480, 576
prism, 500
projectile, 10, 132, 290
propagation, 17, 18, 431, 434, 470, 471, 528, 599
proton, 591, 599
pulley, 98
PV diagram, 267, 273, 275, 280, 282
quantum, 16, 21, 39, 553, 558, 561, 563, 564, 565, 566, 567, 568, 569, 570, 573, 576
quark, 295, 569, 574, 575, 576, 580, 584, 585, 586
radiation, 8, 15, 18, 19, 121, 190, 191, 193, 195, 231, 471, 554, 555, 587, 599, 602
radioactive, 600, 602
radioactive decay, 8, 21, 41, 84, 553, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593
rainbow, 502, 503, 504, 508, 523
RC circuit, 393, 399, 401
reaction, 60, 599, 600, 601
reflection, 18, 111, 440, 471, 481, 482, 483, 484, 485, 486, 488, 489, 497, 500, 501, 502, 503, 509
 critical angle, 500, 502
 diffuse, 481
 internal reflection, 497, 500, 501, 502, 503, 506
 specular, 18, 471, 481, 482
refraction, 8, 18, 111, 437, 471, 497, 499, 500, 501, 502, 505, 508, 509, 554
 index of refraction, 111, 437, 497, 499, 500, 501, 502, 505
relative error, 53, 54, 59, 60, 62, 63, 89
relativistic mass, 551, 552
relativity, 19, 39, 260, 532, 541, 543, 547, 554
resistance, 12, 98, 321, 323, 325, 326, 327, 328, 329, 331, 332, 335, 336, 340, 341, 342, 343, 344, 352, 353, 354, 355, 359, 360, 361, 362, 368, 369, 370, 371, 372, 373, 374, 376, 379, 393, 395, 396, 416, 421
resistivity, 12, 323, 325, 327, 328, 332, 341
resistor, 13, 108, 147, 322, 324, 328, 330, 334, 335, 341, 342, 344, 347, 349, 350, 351, 352, 361, 362, 368, 369, 371, 372, 377, 379, 387, 393, 397, 398, 399, 401, 416
resonance, 8, 446, 447, 450, 452, 453, 457, 554
resultant, 129, 131, 134, 135, 141, 142
scalar, 129, 130, 136, 137, 138, 139, 140, 142, 326, 328, 573
scattering, 504, 528, 529
scientific notation, 66, 69, 96, 125, 126, 127, 128
 using your calculator, 127
secondary color, 479
significant figures, 29, 64, 65, 66, 70, 71, 72, 76, 81, 190, 196, 212, 220, 236, 244, 251, 294, 300, 305, 325, 340, 353, 359, 368, 380, 446, 462, 466, 591, 593
solenoid, 422, 423
solid, 37, 186, 203, 204, 206, 208, 209, 210, 212, 213, 214, 216, 219, 226, 233, 234, 246, 297, 363, 384, 432, 607
solution, 25
sound
 speed of, 438, 446, 448, 450, 451, 452, 458, 465, 466, 467
specific heat, 60
specific heat capacity, 60, 196, 197, 198, 200, 201, 202, 212, 214, 215, 217
spectrum, 473, 474, 476, 478, 500, 502, 529, 559, 562
speed, 18, 20, 42, 70, 97, 101, 118, 121, 182, 191, 193, 208, 222, 421, 428, 429, 430, 437, 438, 446, 448, 450, 451, 452, 458, 463, 465, 466, 467, 471, 472, 473, 474, 530, 534, 535, 542, 543, 544, 545, 546, 547, 549, 551, 552, 556, 562, 565, 566, 571, 585, 586, 591, 599
speed of sound, 438, 446, 448, 450, 451, 452, 458, 465, 466, 467
spring, 17, 75, 76, 140, 150, 431, 433, 440, 452, 578
standard model, 571
strong force, 19, 424, 554, 569, 572, 575, 584, 591
superposition, 17, 430, 470
surroundings, 176, 189, 209, 213, 253, 254, 256, 259, 260, 261, 273, 275, 276, 282, 284, 285, 286
switch, 335, 344, 346, 347, 377, 381, 393, 395, 397, 398, 399, 401
system, 12, 14, 15, 16, 19, 20, 22, 24, 26, 27, 31, 36, 40, 50, 53, 64, 73, 77, 91, 97, 100, 113, 117, 118, 119, 121, 122, 125, 155, 156, 184, 186, 189, 196, 199, 202, 203, 209, 212, 213, 230, 231, 235, 253, 254, 256, 259, 260, 261, 282, 287, 288, 292, 322, 405, 554, 555, 605
Tacoma Narrows Bridge, 431, 434
telescope, 518
temperature, 15, 16, 59, 60, 96, 98, 101, 118, 123, 169, 183, 184, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 197, 198, 199, 200, 201, 202, 203, 204, 205, 207, 208, 210, 211, 212, 214, 215, 216, 217, 218, 219, 220, 221, 223, 225, 226, 227, 229, 230, 231, 232, 233, 235, 236, 237, 238, 239, 240, 241, 242, 243, 245, 246, 247, 248, 249, 252, 253, 254, 255, 259, 260, 262, 263, 264, 266, 268, 269, 270, 271, 272, 276, 280, 281, 283, 284, 286, 287, 326, 327, 341, 410, 439, 451, 458, 468, 602
tension, 17, 103, 150, 437, 447, 455, 456
theory, 24, 31, 34, 35, 234
thermal conductivity, 15, 184, 190, 191, 192, 194, 195
thermal equilibrium, 8, 16, 189, 196, 231, 252, 254, 255
thermal expansion, 98, 184, 186, 220, 221, 222, 223, 225
 expansion joint, 222, 225
thermodynamics, 8, 15, 16, 184, 230, 231, 232, 251, 254, 262, 273, 280
thermometer, 58, 80, 186, 189, 224, 247, 269
time dilation, 531, 547, 548, 552
torque, 98, 142
trigonometry, 95, 96, 129, 131, 497
trough, 431, 436
tsunami, 431, 435
Two-Column Notes, 22
uncertainty, 13, 29, 30, 49, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 68, 70, 71, 80, 81, 88, 89, 90, 93, 323
unit, 54, 117, 120, 123

units, 3, 4, 10, 14, 54, 60, 77, 80, 88, 95, 97, 100, 101, 102, 105, 106, 117, 118, 120, 121, 122, 123, 129, 151, 152, 155, 158, 163, 173, 190, 193, 197, 203, 235, 236, 240, 242, 244, 245, 290, 299, 327, 394, 397, 404, 410, 557, 561, 571

universal gravitation, 548

vapor, 203, 208, 211, 212

vector, 9, 13, 106, 129, 130, 132, 133, 136, 137, 138, 139, 140, 141, 142, 289, 313, 314, 319, 325, 350, 404, 415

 cross product, 96, 139, 141, 142, 415

 dot product, 96, 139, 140, 309

velocity, 4, 20, 28, 45, 47, 63, 86, 101, 104, 107, 108, 109, 110, 111, 113, 115, 133, 137, 138, 140, 149, 173, 176, 177, 178, 179, 180, 182, 249, 252, 311, 329, 410, 415, 418, 419, 428, 431, 432, 437, 438, 439, 447, 462, 464, 465, 467, 497, 498, 499, 505, 532, 533, 534, 535, 536, 537, 538, 542, 543, 544, 545, 546, 547, 548, 551, 552, 555, 565, 587

voltage, 5, 12, 13, 108, 110, 321, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 335, 336, 340, 341, 342, 344, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 359, 360, 361, 362, 363, 368, 369, 371, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 393, 394, 395, 396, 397, 399, 400, 414, 415, 416, 422, 426, 427, 557, 571

water, 60, 62, 205, 207, 238, 600

wave, 8, 17, 18, 19, 20, 21, 109, 111, 329, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 449, 450, 453, 455, 458, 462, 463, 464, 467, 468, 470, 471, 473, 474, 475, 476, 481, 497, 498, 500, 523, 536, 537, 538, 541, 542, 553, 554, 555, 556, 558, 562, 566, 567, 568

crest, 431, 436

electromagnetic, 17, 18, 191, 429, 432, 437, 469, 470, 472, 473, 474, 475, 507, 541, 563

longitudinal, 17, 431, 432, 433, 443, 470

mechanical, 8, 17, 429, 432, 470

standing wave, 17, 21, 430, 442, 447, 453, 458, 470, 556

surface wave, 435

transverse, 431, 433, 434, 435, 436, 440, 443, 458

trough, 431, 436

wavelength, 17, 18, 20, 21, 109, 112, 429, 430, 431, 436, 437, 438, 439, 442, 447, 448, 449, 450, 451, 453, 457, 458, 462, 470, 472, 473, 474, 475, 476, 478, 499, 500, 523, 524, 526, 527, 556, 559, 560, 561, 565, 566

weak force, 569, 572, 584, 585

weight, 80, 153, 156, 157, 158, 159, 165, 166, 167, 170, 172, 186, 264

wire, 14, 329, 335, 341, 343, 346, 360, 380, 381, 393, 394, 404, 405, 414, 415, 416, 417, 420, 421, 422, 424, 601

work, 3, 15, 25, 38, 40, 41, 48, 49, 63, 81, 83, 102, 108, 110, 111, 112, 126, 127, 136, 140, 156, 175, 229, 230, 231, 233, 237, 248, 251, 253, 254, 256, 257, 259, 260, 261, 262, 263, 267, 268, 269, 272, 273, 274, 275, 276, 277, 278, 279, 280, 282, 283, 284, 285, 309, 310, 326, 328, 369, 371, 383, 403, 414, 422, 424, 425, 507, 557, 558, 559, 567, 585, 599, 605

work-energy theorem, 310