

# INDEX

- absorbed dose **75, 76**
- absorption 48
- absorption edges **52**
- absorption spectrum 22
- abundance
  - isotopic 29
  - of elements 30
- acceleration 61
- activity **39, 43**
- ALI 77
- alpha decay 29, **32-34**, 35, 42
- alpha particle **32, 76**
  - energy 33, 34, 35
- amplification 70, 72
- angular momentum 14
- annual intake **77**
- annual limits on intake **77**
- anode 72
- antineutrino 9, 10
- antiparticle 9
- atom 2, 13
  - size of .. 2
- atomic binding energy 16
- atomic mass unit **4**
- atomic number 2, **28**, 60, 61
- atomic photoelectric effect 51
- atomic structure **13-15**
- attenuation **48**
- attenuation coefficient
  - linear **48, 49**
  - mass **49**
- attenuation law 48
- attenuation length 49
- avalanche 72
- average binding energy per nucleon **30**
  
- background 76
- background radiation **77-78**
- bandwidth 25
- becquerel **39**
- Becquerel, Henri 32
- beta decay 29, 32, **35-37**
  - energy 35
- beta spectrum 35
- beta stability **29-30**, 31, 35, 45
  - line of **29-30**, 31, 35, 45
- beta-minus decay 35, 36
- beta-plus decay 35, 36
- big bang 30
- binding 15
- binding energy
  - atomic 16
  - nuclear **30-32**, 44
- biological effects of radiation **75**
- bismuth 42
- Bohr model 13
- Born 7
- braking radiation 61
- bremsstrahlung 58, **61-62**
- bubble chamber 73
- build-up 50
  
- cancer 81
- carbon 40
- carbon-14 28, 41, **77**
- carcinogenesis 80
- cascade 62
- CAT 88
- cathode 73
- chain decay 38, **42-44**
- chain reaction 44
- characteristic x rays **83, 84**
- Cherenkov radiation 58, **63**
- cloud chamber 73
- coherent light 25
- collision 58, 59, 61, 62
- Compton edge 54
- Compton effect **54-55**, 56
- Compton scattering (see Compton effect)
- computer 87
- computerised axial tomography 88
- conduction band 17, 74
- conduction electron 17, 52
- conservation of
  - energy 4, 59
  - kinetic energy 65
  - mass 4
  - mass-energy 4
  - momentum 59, 65
- continuous spectrum 82, 83
- cosmic rays 40, 77, 78
- Coulomb barrier 33, 34
- Coulomb repulsion 44
- critical energy 62
- crystal 17
- Curie 32
  
- daughter 32, 35, 42, 43
- Davisson and Germer 7
- de Broglie 7
- de Broglie waves **6-8**
- decay
  - constant **38**
  - law of 38
  - rate 39
- decay constant 39
- delta rays 59
- density 49, 59, 64
- density of ionisation 76
- density-thickness **49, 58**
- detector
  - gas-filled **70**
  - multiwire **72**
  - scintillation **73**
  - semiconductor **74**
  - solid state **74**
- deuterium 44
- diffraction 5, 7
- dose 75, 76
- dose equivalent **76, 77, 78**
- down quark 9, 36, 37
- dynode 73
- efficiency 73
  
- Einstein's relation **2-4**
- elastic scattering 65
- electric field 70
- electrode 70

- electromagnetic interaction 58, 59  
 electromagnetic radiation 5  
 electron 2, 4, 5, 9, 14, 29  
   conduction 74  
   energy loss 61  
 electron antineutrino 35  
 electron capture **37**  
 electron neutrino 35  
 electron state **14**, 15  
 electron-hole pair 74, 75  
 electronvolt **4**  
 element 2  
 elementary wave 6  
 emission spectrum 22  
 energy **2**, 8, 15, 35  
   alpha particle 33, 34  
   conservation 59  
   of photon 5  
 energy bands **17**  
 energy level **15-17**  
   molecular 17  
 energy-level diagram 16  
 equilibrium  
   secular **44**  
 exchange particle 10  
 excitation 58, 59  
 excited state **16**, 24  
   nuclear 38  
 exclusion principle **15**  
 exposure 75  
  
 fallout 78  
 Feynmann diagram **10-11**, 36  
 film badge **74**  
 fission **44**, 65  
 fission fragment 44, 65  
 flavour 36  
 fluorescence 73  
 forbidden energy gap 17  
 free particle 3  
 fundamental forces 10  
 fusion **44**  
  
 gamma decay **38**  
 gamma ray 38, 76, 81  
 gas amplification **70**, 72  
 gas-filled detector **70**  
 Geiger counter 39, **71-72**, 76  
 genetic defects 80  
 genetic effects of radiation 75  
 gluon 10  
 gold 30  
 graviton 10  
 gray **75**  
 ground state 16, 18, 24  
 growth rings 41  
  
 half life 32, 34, 36, **39**, 40  
 half thickness **49**  
 Heisenberg 8  
 helium 23, 24, 30, 32, 44  
 hole 74  
 hydrogen 30, 44  
 hydrogen atom 4, 13, 14, 16  
  
 ICRP 76, 77, 78  
 image intensifier **74**  
 inelastic scattering 65  
  
 insulator 53  
 interference 7  
 International Commission on Radiological Protection (see ICRP)  
 ion 18  
 ionisation **18**, 58, 59, 61, 75  
   specific 75  
 ionisation chamber **70**, 75, 76  
 ionisation current 76  
 ionisation density 76  
 ionisation energy **16**, 18, 51  
 irradiance 25  
 isobar **28**, 35  
 isotope 2, **28**, 42  
 isotopic abundance 29  
  
 K series 84  
 kinetic energy 2, 3, 15, 59, 60, 61, 62, 65  
 knock-on electrons 59  
  
 laser **23-25**  
 lead 30, 42  
 lepton **9**, 10  
 light 5  
 light-dependent resistor 53  
 line of beta stability **29**, 30, 31, 35  
 linear attenuation coefficient **49**, 56  
 linear stopping power **58**  
  
 magnetic field 85  
 magnetic moment 85  
 mass **2**, 32, 35  
 mass and energy **2-4**  
 mass attenuation coefficient **49**, 50, 51  
   Compton 55  
   Rayleigh 55  
   total **56-57**  
 mass number 2, **28**  
 mass stopping power **58**  
 mean free path **49**  
 minimum ionisation 60  
 minimum ionisation energy 61  
 molecule 2, 17  
 molybdenum 82, 83  
 momentum 4, 6, 7, 8, 59  
   of photon 6  
 Moseley's law 84  
 multi-wire detector **72**  
 muon 10  
 mutation 75  
  
 neon 23, 24  
 neutrino 9, 10, 35  
 neutrino's rest mass 35  
 neutron 2, 4, 9, 10, 28, 44, 65  
   interaction 65  
 neutron interactions **65**  
 neutron number **28**  
 Niels Bohr 13  
 nitrogen 40, 77  
 NMR **85-88**  
 NMR imaging **87-88**  
 NMR spectroscopy **86**  
 nuclear interaction 65  
 nuclear magnetic resonance **85-88**, (see also NMR)  
 nuclear reaction 40, **44-45**  
 nuclear size **28**  
 nucleon 2, 10, 28, 30

- nucleus 2, **27**, 55, 61  
 size of **28**
- nuclide 2, **28**
- orbital angular momentum 14
- pair production 51, **55-56**, 62
- particle track 72
- particles **8**
- periodic table 29
- photocathode 73, 74
- photoconductivity 53
- photodiode 53
- photoelectric effect 5, 6, 51, **53**, 56, 73  
 atomic **51-52**  
 condensed matter **52-53**
- photoelectron 51, 74
- photographic emulsion 74
- photoionisation 51
- photomultiplier 53, **73**
- photon **5**, 6, 9, 10, 19, 24, 36, 51
- Planck's constant 5, 8, 51
- plutonium 77
- polonium 42, 78
- positron 4, 9, 29, 36  
 energy loss 61
- potassium-40 78
- potential difference 70
- potential energy 15
- principal quantum number **14**, 15, 16
- probability 38
- product nucleus 33, 35
- proportional counter **71-72**
- proton 2, 4, 9, 10, 28
- quality factor **76**
- quantisation **14**
- quantum efficiency 73
- quantum mechanics 5, 14
- quantum number 14  
 orbital angular momentum 14  
 principal 14
- quark **9**, 11, **36**
- rad 75
- radiation 48, 70
- radiation dose 75
- radiation length 62
- radiation limits 78
- radiation loss 61
- radiative capture 65
- radiative transition **19-20**, 21
- radioactive dating **40-41**
- radioactive decay 29
- radioactive nuclide 29
- radioactive series **42-44**
- radioactivity **32-44**
- radiocarbon dating 40
- radionuclide **29**, 40  
 in the body 77
- radium 33, 42
- radon 33, 42, **78**
- range **60**, **61**  
 alpha particle 34  
 beta particle 36
- rate of decay 39
- rate of energy loss 58
- Rayleigh scattering **55**
- RBE 76
- reaction  
 nuclear **44-45**
- reactor 45
- relative biological effectiveness 76
- relativistic factor **3**
- relativity 2
- rem 77
- resonance 85
- rest energy **3**, 4, 54
- rest mass **3**, 4, 10, 32
- roentgen 75
- Röntgen, Wilhelm 32, 81
- Rutherford 13
- Rutherford-Bohr model 13
- saturation 72
- scattering 48, **58**, 59  
 elastic 65  
 inelastic 65
- Schrödinger 7
- scintillation 73
- scintillation counter **73-74**, 76
- scintillator **73**
- secondary electron 73, 78
- secondary ion 72
- secondary particle 50, 77
- secular equilibrium **44**
- semiconductor 53, 74
- semiconductor detector **74**
- sensitive volume 69
- series decay. 38
- shell 14, **15**, 16, 83, 84
- shielding 50
- shock wave 63
- short wavelength cut-off 83
- sievert 76
- signal processing 69
- silver bromide 74
- size of an atom 2
- solar system 78
- solid state detector **74-75**
- specific activity **39-40**
- specific ionisation 75
- spectator 36
- spectra (see spectrum)
- spectrum **21-23**
- speed 4
- speed of light 2, 51, 60, 63
- spontaneous emission **20**
- stability  
 beta **29-30**, 31, 35, 45  
 line of **29-30**, 31, 35, 45  
 nuclear **29-30**  
 valley of 31
- standard model 9
- state 14  
 atomic **14**  
 electron **14**, 15
- stimulated emission **23-25**
- stochastic effect 75, 80
- stopping power **58**, 59  
 linear **58**  
 mass **58**, 59
- straggling **61**
- strong nuclear force 33
- structure of atoms **13-15**

---

subshell 14, **15**, 16  
supernova 30, 78

tauon 10  
thallium 42  
Thomson, G.P. 7  
thorium 42, 78  
three-body process 35  
time 8  
total energy 3  
track 72  
transuranic nuclei 45  
tritium 44  
tungsten 82  
tunnelling 34  
two-body decay 35

ultraviolet light 52  
uncertainty principle 8  
unstable state 24  
up quark 9, 36  
uranium 32, 78

valence band 17, 74  
valley of beta stability 31  
Van der Graaff machine 85  
vector boson 10  
velocity 4

wave-particle duality 5, **7-8**  
weak nuclear force 36  
white dwarf 30  
work function 6

x rays 32, 78, **81-85**  
    characteristic **83**  
x-ray  
    line 37  
x-ray energies 85  
x-ray photon 37, 83  
x-ray spectrum **82-84**  
    continuous **83**  
    line 83  
x-ray tube **82**, 83

Young's experiment 7