

---

# Index

- Absorption, 76, 328
- Accountability principle, 516
- Acidity, 271
- Acquisition of knowledge, 607
- Activation energy, 284
- Adhesion, 336
- Adsorption, 13, 275, 282, 348
  - energy, 277
  - isotherm, 277
- Adsorption/desorption reactions, 270
- Aerodynamic diameter, 171
- Aerosol, 164
  - filtration, 228
  - fraction, 173
  - monitoring, 171, 174
- Agglomerate, 165, 172
- Agglomeration, 336
- Aggregate, 165, 172
- Aggregation, 273, 326, 336
- Air purification, 225
- Airborne particles, 148
- Aluminium hydroxide, 275
- Alveolar fraction, 168, 171
- Ames test, 116
- Amosite, 9
- Amphibole, 18
- Amphipod, 341
- Anatase, 273, 279
- Aneugenic mechanism, 112
- Animal experimentation, 69
- Animal model, 64
- Anisotropy, 277
- Anthophyllite, 9
- Antibody, 330
- Antioxidant, 337
- AP-1, 102
- Apoplatic route, 349
- Apoptosis, 7, 73, 126
- Applied ethics, 427
- Aquatic organisms, 326, 327
- Artificial
  - agent, 596
  - conscience, 595
  - intelligence, 593
- Asbestos, 5, 9
  - bodies, 19
- Asbestosis, 5
- Asimov's laws, 591
- Asimov, I., 589, 591, 596
- Assessment, 424
- Attachment efficiency, 313
- Bacteria, 326
  - Gram-negative, 332
  - Gram-positive, 332
- Bacterial
  - community, 336
  - physiology, 337
  - wall, 330
- Band gap, 280
- Barrier, 37
- Benthic invertebrate, 380
- Binding energy, 284
- Bioavailability, 330
- Biocompatibility, 374
- Biodistribution, 55, 68

- Biodurability, 21
- Biofilm, 331
- Biogeochemical cycle, 332
- Biological
  - barrier, 325
  - media, 284
- Biomarker, 14
- Biomass, 332
- Biopersistence, 9, 21, 245
- Biotechnology, 427
- Boehmite, 271
- Bovine serum albumin, 328
- Brain, 347
- Bridging flocculation, 307
- Broncho-alveolar lavage, 12
- Brookite, 279
- Brownian motion, 274, 310
- BSG-CSO, 502
  
- Cadmium, 348
- Cancer, 7
- Čapek, K., 588, 590, 595, 596
- Capture at source, 226
- Carbon, 9
- Carbon black, 123
  - effect on hatching, 341
- Carbon nanotube, 22, 297, 326
- Carcinogen risk assessment, 214
- CATHIA, 169
- Cationic polystyrene nanosphere, 128
- Causality, 213
- Cell, 331
  - adaptation, 338
  - division, 338
  - epithelial, 11
- CeO<sub>2</sub>, 337
- Ceriodaphnia dubia*, 365
- Cerium, 125
- Charter of fundamental rights of the European Union, 501
- Chemical
  - affinity, 282
  - probe, 282
  - risk assessment, 168
- Chemokine, 100
- Chloroplast, 332
- Chromosome, 18, 338
  - mutations, 115
- Chrysotile, 9
  
- Clastogenic mechanism, 112
- Clean tech, 602
- Clearance, 43
- Cleavage, 272
- Closed systems, 224
- Cluster, 420
- Co-contamination, 347
- Coagulation, 172, 302
- Coal mining, 6
- Cobalt, 123
- Code of conduct, 421, 496–508, 563
- Code of ethics
  - for robots, 594
- Collective safety measures, 224, 244, 258
- Collision efficiency, 309
- Colloidal stability, 327
- Comet test, 115
- COMETS, 439, 445, 446
- Common values, 432
- Complexity, 423
- Computer delinquency, 594
- Concentration
  - mass per unit volume, 174
  - number per unit volume, 174
  - surface area per unit volume, 174
- Conduction band, 278
- Consumer protection, 475
- Conventional fraction, 169
- Convergent technologies, 421, 516
- Coordination, 270
- Corona, 91
- Cost–benefit analysis, 512
- Credibility, 424
- Critical coagulation concentration, 303, 328
- Crocidolite, 9
- Cross-disciplinary approach, 423
- Crustacea, 338
- Crystal
  - chemistry, 326
  - defect, 284
  - face, 271, 276
  - growth, 282
  - structure, 269
- Cutaneous route, 44
- Cyborg, 597
- Cytokine, 88
- Cytoplasm, 331

- Cytoskeleton, 332  
 Cytotoxicity, 13, 72, 98  
  
*Danio rerio*, 338  
*Daphnia magna*, 338  
 Democracy, 430  
 Deontology, 587  
 Deposition, 40  
 De Garis, H., 597  
 Dielectric constant, 278  
 Diesel particles, 129  
 Diffusion column, 314  
 Digestive route, 46  
 Dignity, human, 556  
 Dissolution, 329  
 Dissolution–recrystallisation process, 337  
 Distribution, 76  
 DLVO theory, 274, 301  
 DNA, 19, 328, 338  
   adducts, 112  
   primary alterations, 115  
 Dose, 214  
 Dose–response relationship, 211, 215  
 Double strand breakage (DSB), 113  
 Drug delivery, 325  
 Dust, 3  
 Dustiness, 189  
  
 Economics, 563  
 Ecosystem, 327  
 Ecotoxicity, 270  
 Ecotoxicology, 325  
 Edema, 346  
 EGFR, 104  
 Electron transfer, 281, 337  
 Electron transfer chain, 332  
 Electron–hole pair, 278  
 Electrostatic attraction, 282  
 Electrostatic interactions, 271  
 Electrostatic repulsion, 299, 327  
 Elf, 593  
 Elimination, 55  
 ELSA research, 437, 444  
 Encapsulation, 372, 375  
 Endocytosis, 48  
 Endodermis, 349  
 Energy, 602  
 Entropy of information, 595  
  
 Environmental  
   exposure, 201  
   justice, 429  
   risks, 325  
   stress, 338  
 Epibenthic invertebrate, 380  
 Epidemiology, 147, 212  
 Epidermis, 349  
 Epithelial  
   barrier, 71  
   cell, 346  
 Equivalent diameter, 171  
*Escherichia coli*, 328  
 Ethical criteria, 421  
 Ethics, 445, 449, 563  
   definition, 427  
   of information, 597  
   of robots, 588  
   roadmap, 598  
 Eukaryote, 331  
 European Group on Ethics in Science and New Technologies (EGE), 501  
 European Nanotechnology Observatory, 519–539  
 European research area, 498, 580  
 European Robotics Research Network, 591  
 European Technology Platforms, 522  
 Excess surface energy, 283  
 Exciton, 278  
 Excretion, 77  
 Exopolymer, 332  
 Exopolysaccharide, 333  
 Expert independence, 425  
 Exposure, 37, 66, 163, 168, 326, 399, 606  
   by cutaneous route, 68  
   by oral route, 68  
   by respiratory route, 66  
   monitoring, 244  
   to nanoaerosols, 170  
  
 Factory doctor, 255  
 False hopes, 425  
 Fatty acid, 337  
 Fe<sup>2+</sup>, 329  
 Fenton reaction, 329, 337  
 Fertilization, 341  
 Fibre

- artificial inorganic, 8
- ceramic, 8
- dimensions of, 19
- effect, 101
- Fibroblasts, 11, 13
- Fibrosis, 7
  - diffuse interstitial, 6
  - nodular, 6
- Filament, 333
- Filtration, 223
- Fimbriae, 333
- Fine particle, 8, 10
- Florida, L., 596–598
- Fluorescent in situ hybridization (FISH), 117
- Food chain, 415
- Formation energy, 284
- Free radical, 274
- Fullerene, 121, 296
- Funding for nanotechnologies, XXXV, 533
- Future generations, 430
- Gene, 338
  - expression, 102
  - mutations, 115
  - redox sensitive, 93
  - therapy, 430
  - transcription, 88
  - tumour suppressor, 7
- Genetic information, 331
- Genome, 332
- Genotoxicity, 14, 73, 112, 214, 341, 374
- Gill, 347
  - pathology, 341
- Globalisation, 424, 560
- Glutathione peroxidase, 93
- Gold nanorod, 330
- Golem, 589
- Good practice in the workplace, 221
- Governance, 432
- Grenelle environment forum, 455, 470, 553
- Growth factor, 327
- H<sub>2</sub>O<sub>2</sub>, 94
- Hazard, 220, 399, 606
- Health, 222, 602
  - events, 211
  - risks, 325
  - surveillance, 255
- Heme oxygenase, 97
- Hepatic pathology, 341
- Homothety, 277
- HPRT assay, 116, 126
- Human
  - condition, 431
  - dignity, 556
  - rights, 428
- Human sciences, 438, 444
- Humic acid, 333
- Hybrid capsules, 372
- Hydrodynamic diameter, 327
- Hydrogen peroxide, 94
- Hydrophilic–hydrophobic balance, 274
- Hydrophilicity, 295, 331
- Hydrophobicity, 295, 296, 330
- Hygiene, 219, 238
- Immune system, 328
- In vitro models, 69
- Industrial property, 560
- Inequalities, 429
- Inflammation, 24
- Inflammatory response, 214
- Information and communication technology, 602
- Information ethics, 595
- Informational entity, 595, 596, 598
- Infosphere, 595
- Ingestion, 163, 338
- Inhalable fraction, 168
- Inhalation, 20, 66, 163
  - of nanoparticles, 170
- Insolubility, 330
- Institutions, 430
- Integrative approach, 425
- Integrity of the human species, 556
- Intelligent agent, 593
- Interface, 270
- Interfacial
  - reactivity, 325
  - tension, 273, 327
- Interference, 75
- Internalisation, 47, 72
- International norms, 432
- International Standards Organization, 522, 603

- Intestine, 341
- Intraperitoneal injection, 19
- Intrapleural injection, 19
- Intratracheal instillation, 11
- Ionic strength, 328
- Iron, 127
  - octahedron, 282
  - oxide, 282
  - tetrahedron, 282
- Irreversibility, 580
- Isoelectric point, 272
  
- Joint Technology Initiatives, 522
- Joy, B., 597
- Judgement, 427
- Justice, 427
  
- Knockout mouse, 22
  
- Labelling, 478
- Law, 551
- Leaf, 350
- Legitimate use, 431
- Life cycle, 557
- Ligand, 276
- Lipid, 331
  - peroxidation, 96, 337
- Lipopolysaccharide, 337
- Lisbon strategy, 498
- Liver, 347
- Living organism, 325
  - mobility, 338
- Ljubljana process, 498
- Lung, 21
  
- Macromolecule, 307, 331
- Macrophage, 13
  - alveolar, 11
- Maghemite, 127
- Magnetite, 273
- MAPK, 102
- Mathematical model, 77
- Measurement
  - criteria, 170
  - strategies, 180
- Medical
  - examination, 257
  - surveillance, 252
- Membrane, 11, 96, 331
  - damage, 73
  - permeability, 333
- Mesothelial cell, 14
- Metabolism, 77
- Metal oxide, 295
- Metastable entities, 273
- Metric, 173
- Micro-organisms, 327
- Micronucleus test, 117
- Millennium Development Goals, 543
- Mineralisation, 281
- Mitochondria, 332
- Mobility diameter, 171
- Monolayer, 277
- Moravec, H., 597
- Morphology, 326
- Mortality, 341
- MoS<sub>2</sub>, 283
- Mouse
  - genetically modified, 20
  - knockout, 20
  - lymphoma assay, 116
- Multi-compartmental model, 78
- Multiwall carbon nanotube, 120
- MUSIC, 271
- Mutagenesis, 20
- Mutagenicity, 73
  
- Nano-effects, 325
- Nano-object, 164
- Nanoaerosol, 164
  - exposure to, 170
  - monitoring, 164, 193
- Nanocomposite, 166
- Nanoethics, XXXIII, 587, 596, 598
  - roadmap, 596
- Nanomaterial, 163, 164, 166, 603
  - adventitious, 404
  - deterioration, 404
  - life cycle, 202, 325, 401
- Nanometric byproducts, 404
- Nanoparticle, 5, 8, 10, 163, 164, 166
  - as metastable system, 272
  - bactericide effect, 328
  - bioavailability, 332
  - carbon, 326
  - cardiovascular effects, 101
  - chemical instability, 284
  - chemical nature, 326

- chemical stability, 326
- crystal structure, 326
- definition, 269
- dissemination, 325
- edge, 284
- emission, 189
- epidemiological data, 148
- in respiratory system, 42
- metal, 270, 297, 326
- metal oxide, 270, 326
- mobility, 332
- morphology, 275
- passivation, 371
- penetration, 325
- physicochemical properties, 270
- protection techniques, 370
- reactivity, 325
- surface functionalisation, 326
- surface saturation, 282
- TiO<sub>2</sub>, 331
- Nanopowder, 184, 189
  - nanodustiness, 189
- Nanoproduct, 425
- Nanostructure, 166
- Nanostructured particle, 166, 167, 172
- Nanotechnology, 601
  - acceptability, 574
  - funding, 533
  - patents, 528
  - publications, 527
- Nanotoxicity, XXXIII
- Nanotoxicology, 326
- NBIC convergence, 445, 446, 473, 554, 556, 562, 580
- Neoplastic transformation, 18
- Neuronal pathology, 341
- NF- $\kappa$ B, 90, 102
- Norm, 423
- Nuclear energy, 430
- Nucleic acid, 331
- Nucleoid, 331
- Nucleus, 331
- Number concentration, 205
- Nutrient, 327
  - solution, 327
- ObservatoryNANO project, 519–539
- Occupational exposure, 169, 172, 183, 219
  - factors, 183
  - limit, 191
  - reference concentration values, 191
  - scenarios, 183
- Occupational health, 167
- OECD, 521, 609
- Oncogene, 7
- Organelle, 332
- Organisational measures, 231
- Osmoregulation, 347
- Osmotic lysis, 332
- Ostwald ripening, 273
- Oxidation, 279, 329
- Oxidative stress, 73, 118, 214, 285, 337
- Patents, 525, 528
- PATSTAT, 528
- PBPK, 78
- Pelagic invertebrate, 380
- Percutaneous route, 163
- Periodicity, 270
- Personal safety, 233
  - equipment, 222
  - measures, 244, 258
- Pesticide, 281
- pH, 327
- Phagocytosis, 17, 48
- Pharmacokinetic models, 77
- Pharmacokinetics, 76
- Phenanthrene, 349
- Phloem, 348
- Phospholipid bilayer, 332
- Photo-oxidation, 280
- Photoactivation, 121
- Photocatalysis, 278
- Physicochemical analysis, 179
- Physicochemical characteristics, 25
- Phytotoxicity, 348
- Pili, 333
- Plankton, 331
- Plant, 326, 327, 348
- PM<sub>10</sub>, 10, 170
- PM<sub>2.5</sub>, 10, 170
- Pneumoconiosis, 6
- Point of reference, 432
- Point of zero charge, 295
- Political community, 432
- Political philosophy, 432
- Pollutant, 282, 348

- Polycyclic aromatic hydrocarbons (PAH), 114
- Polymer, 274
- Polymorph, 280
- Polyols, 276
- Polysaccharide, 331
- Porous medium, 312
- Precautionary principle, 172, 425, 515, 554, 579, 605
- Prevention, 163
- Primary safety measures, 244, 256
- Principles, 427
- Privacy, 594
- Pro-apoptotic cascade, 104
- Procedural justice, 432
- Professional environment, 238
- Prokaryote, 331
- Protective clothing, 236
- Protein, 96, 327, 331
- Protonation, 271
- Protonation–deprotonation equilibrium, 275
- Protoplast, 349
- Pseudokirchneriella subcapitata*, 365
- Public attitude, 575
- Public awareness, 424
- Public deliberation, 429
- Publications on nanotechnology, 527
- Pulmonary
  - pathology, 100
  - surfactant, 328
- QD 705, 81
- Quality of life, 602
- Quantum dot, 81, 128, 364, 365, 370
- Quartz, 9
- Radical uncertainty, 582
- REACH, 511, 537, 552, 555, 604
- Reactive nitrogen species (RNS), 111
- Reactive oxygen species (ROS), 16, 94, 97, 111, 285, 329
- Reactive sites, 282
- Red blood cell, 16
- Redox
  - cycle, 337
  - effects, 336
  - potential, 280
  - properties, 326
  - reaction, 279
- Reduction, 329
- Regulation, 221, 563
- Replication, 338
- Reproduction, 341
- Respiratory
  - protection, 233
  - route, 39
  - system, 328
- Responsibility, 424, 430, 432
- Responsible development, 421
- Rio Conference, 542
- Risk, 163, 398, 423, 606
  - assessment, 215, 220, 428
  - environmental, 428, 465
  - health, 428
  - perception, 575
- Risk–benefit analysis, 511–516, 579
- RNA, 338
- Roboethics, 587, 588, 595, 596, 599
  - laws of, 596
  - roadmap, 593
- Robotics, 587, 596
  - code of ethics, 594
  - virtual, 590, 593–595
- Root cortex, 349
- Roots, 348
- Rutile, 279
- Safety, 219, 602, 607
  - at work, 222
  - data sheets, 237
  - measures, 220, 221
  - practices, 221
- Salinity, 347
- Sampling, 178
  - efficiency, 169
- SCENIHR, 501
- Schrödinger equation, 280
- Science and Society Action Plan, 501
- Security, 602
- Sediment, 341
- Semantic fog, 420
- Semiconductor, 278
- Shannon, C., 595
- Short term effect, 212
- Silica, 9, 128
- Silicosis, 4
- Silver, 124

- nanoparticle, 330
- Single strand breakage (SSB), 113
- Single wall carbon nanotube, 119
- Single-cell organism, 331
- Size, 326
- Society, 560
- Socio-economic analysis, 512
- Solubility, 284, 329
  - product, 284
- Solvation, 271
- Specific surface area, 204, 282, 326
- Spinoza, 598
- Standards, 423, 564
  - technical, 563
- Stereochemistry, 277
- Steric
  - interactions, 274
  - repulsion, 327
- Stockholm Earth Summit, 542
- Storage, 232
- Stress, 12, 102
- Substitution, 223
- Sunscreen cream, 408
- Superoxide
  - anion, 93
  - dismutase, 93, 337
  - radical, 94
- Surface
  - atoms, 270
  - charge, 326
  - complexes, 274
  - energy, 269, 272
  - enthalpy, 273
  - key role of, 270
  - pressure, 282
  - reactivity, 245, 270
  - tension, 273, 284
- Sustainable development, 430, 541
  
- Target organ, 329
- Taxon, 379
- Taxonomy, 421
- Technegas process, 80
- Technetium, 80
- Thermodynamics, 272
- Thiol, 330
- Thoracic fraction, 168
  
- Titanium, 125
  - dioxide, 279
- Toxicity, 163, 270, 325, 405
- Toxicokinetics, 76
- Traceability, 468, 557
- Training, 424
- Transgenic mouse, 116
- Translocation, 51, 68, 72, 348
- Transparency, 607
- Transpiration, 348
- Transverse technology, 601
- Trophic exposure route, 347
- Tumour, 325
  
- UDS assay, 115
- Ultrafine particle, 8, 10, 88, 167, 180
  - epidemiological data, 148
- Uncertainty, 217, 606
- United Nations, 541–548
- Unpredictability, 428
- UV radiation, 329
  
- Vacancy, 284, 337
- Valence band, 278
- Values, 427, 562
- Van der Waals forces, 274, 299
- Ventilation, 222
- Veruggio, G., 590
- Viability, 341
- Vigilance, 423
- Volatile organic compounds, 281
  
- Waste processing, 233
- Wiener, N., 589
- WIPO, 525
- Work area, 231
- Working conditions, 238
- Working Party on Manufactured Nanomaterials, 609
- World Summit on Sustainable Development, 547
- Wulff's theorem, 275
  
- Xenobiotics, 325
- Xylem, 348
  
- Zinc, 127
  - oxide, 367, 368, 373