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Term	Definition	Reference
1D Nanostructure	A structure with 1 of its dimensions at the nanoscale such as a film or coating.	
2D Nanostructure	A structure with 2 of its dimensions at the nanoscale such as a nanorod or nanotube.	
3D Nanostructure	A structure with all 3 of its dimensions at the nanoscale such as a nanoparticle.	
AFM (Atomic force microscope)	First developed in 1985, an AFM or scanning probe microscope (SPM) is able to measure local conditions of a sample including surface roughness, height, friction and magnetism that allows an 'image' of the sample to be built up with resolution on the order of fractions of a nanometer. An AFM works by using a probe tip on a cantilever arm that is used to scan across the surface of the sample.	http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.56.930
Angstrom (Å)	A unit of length equal to one ten-billionth of a metre (10-10m) or 0.1 nm. This is a convenient unit for measuring molecule bond lengths.	
Auger electron spectroscopy	First developed in 1920s, Auger electron spectroscopy can measure the composition of a surface (up to a few nm thick). A focused beam of electrons is directed onto the material and interact with the atoms on the material's surface. The result of this interaction is the release of energy, in the form of photons or electrons (also known as Auger electrons), which are detected and their energies are measured and plotted.	http://hyperphysics.phy-astr.gsu.edu/hbase/atomic/auger.html
Biotechnology	The production and development of products (e.g. pharmaceuticals) which use or modify biological systems. Nanotechnologyis an important branch of biotechnology, for example, the addition of nanoparticals can help with the delivery of drugs and the performance of biological materials and medicine, or the effectiveness of an agricultural fertilaizer.	https://www.bio.org/articles/what-biotechnology
Bottom up	There are commonly held to be two ways of manufacturing nanomaterials. The first is bottom up, where nanomaterials are built up one atom at a time. This process can be slow and laborious. The bottom up approach replicates the way in which organic matter in nature (such as the way in which DNA comes together in living organisms) is built up into larger structures. Self-organisation is a bottom up process in which the conditions that allow material to arrange themselves in specific ways to create new structures.	http://nimet.ufl.edu/nanomed.asp http://www.nano.gov/nanotech-101/what/manufacturing
Catalyst	An element or substance which increases the speed of a chemical reaction which itself remains unchanged during the process. Different catalysts are required for different chemical reactions.	http://www.bbc.co.uk/schools/gcsebitesize/science/add_edexcel/chemical_reactions/ratesrev4.shtml
Colloids	A liquid containing nano-sized particles which do not settle to the bottom but retain an even suspension.	http://chemwiki.ucdavis.edu/Core/Physical_Chemistry/Physical_Properties_of_Matter/Solutions_and_Mixtures/Colloid
Covalent bond	A strong chemical bond between atoms where electrons are shared.	http://hyperphysics.phy-astr.gsu.edu/hbase/chemical/bond.html
Crystal structure	The regular or ordered arrangment of atoms in a liquid or solid. The pattern is periodically repeated in three dimensions.	http://www.ce.berkeley.edu/~paulmont/CE60New/crystal_structure.pdf

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Diatomic molecules	Diatomic molecules are those which contain only two atoms. These can be the same, or different element, e.g. carbon monoxide. There are only five elements that can make diatomi c molecules containing two atoms of the same element at standard temperature and pressure: hydrogen, nitrogen, oxygen, fluorine, and chlorine.	http://www.britannica.com/science/diatomic-molecule
Diffraction	The change in direction of a wave after passing through a slit or aperture. Diffraction is the mechanism which allows light (or electrons in an electron microscope) to bend.	http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/diffracon.html#c1
Dipole-dipole interaction	The intermolecular interaction between two polar molecules (molecules which have a positive and negative end).	https://www.chem.purdue.edu/gchelp/liquids/dipdip.html
Disruptive technologies	New technologies that displace older technologies and enable radically new generations of existing products and processes to take over. Nanotechnology is often descriped as a disruptive technology.	http://whatis.techtarget.com/definition/disruptive-technology
Dual polarization interferometry (DPI)	A laser beam is focused on the surface of a material to measure changes in functioning biomolecules (e.g. changes in levels of protein).	http://www.sciencedirect.com/science/article/pii/S0003269704001678
EELS (electron energy loss spectroscopy)	A thin material is exposed to a beam of electrons with known energy. As the electrons pass through the material, the energy of the electrons can change due to scattering. After having passed through the material the energies of the electrons are measured by an electron spectrometer. A spectrum is produced showing the number of electrons at each energy. This spectrum provides information about the elements present in the material and the type of bonding between atoms. EELS can also be used to measure the thickness of a thin material. First developed in the 1940s. EELS is performed in a TEM (Transmission Electron Microscope). At length scales below 100 nanometers, quantum phenomena become important and new functionalities are observed which are size-dependent.	http://www.tem-eels.ca/egerton-laser/preprint/Egerton%20RPP'09%20EELS%20in%20TEM.pdf
Emergent and divergent phenomena	Qualitative and/or quantitative evaluation of the intake of an agent with regard to the relevant routes of exposure in individual cases (e.g. intake through food intake, breathing or skin contact).	
Exposure assessment	Altering the surface of a material by bringing physical, chemical or biological characteristics different from the original state. This can result in special properties for specific applications.	BfR Guidance Document for Health Assessment
Functionalisation	A single layer of graphite. Graphite has a layered structure, where carbon atoms are arranged in a honeycomb/chicken wire hexagonal arrangement in each layer.	http://www.sciencedirect.com/science/article/pii/S0927796X10000756 http://www.aspbs.com/nanoparticle.html
Graphene	A single layer of graphite. Graphite has a layered structure, where carbon atoms are arranged in a honeycomb/chicken wire hexagonal arrangement in each layer.	http://www.nanowerk.com/n_encyclopaedia.php
Graphene	A form of carbon in a two-dimensional, atomic-scale, hexagonal lattice in which one atom forms each vertex. Graphene is becoming a very important material, due to its	https://www.nobelprize.org/nobel_prizes/physics/laureates/2010/advanced-physicsprize2010.pdf

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	unusual properties such as mechanical strength, thin-ness, transparency and thermal and electrical conductance.	
Hazard	Hazard is associated with the intrinsic ability of an agent or situation to cause adverse effects to a target such as people, environment, etc. This ability may even never materialize if, for example, the targets are not exposed to the hazards or made resilient against the hazardous effect.	Scheer, Dirk et al.: "The Distinction Between Risk and Hazard: Understanding and Use in Stakeholder Communication". Risk Analysis, Vol. 34, No. 7, 2014, pp.1271. Bundesinstitut für Risikobewertung (BfR). Questions and Answers on Nanotechnology, Updated FAQ of 28 August 2012.
Hazard characterisation	Qualitative and/or quantitative evaluation of adverse health effects that could arise from the risk source, if necessary under consideration of a dose-response relationship.	BfR Guidance Document for Health Assessment
Hazard identification	Identification of the biological, chemical or physical agent which could have adverse health effects.	BfR Guidance Document for Health Assessment
Hydrocarbons	An organic compound made up of only hydrogen and carbon atoms. They are extracted from crude oil. They can be separated into three groups depending on their bonding type.	http://www.bbc.co.uk/bitesize/standard/chemistry/materialsfromoil/hydrocarbons/revision/1/
Immiscible	Liquids which are unable to mix and form separate layers when shaken together, such as vinegar and oil in a salad dressing. Nano emulsions are the most common form of nanoscale immiscible liquids, where the droplet size is 20–200 nm. They are most commonly used in cosmetics but also in health care, the food industry, and in agriculture.	http://www.chemguide.co.uk/physical/phaseeqia/immiscible.html http://www.tandfonline.com/doi/abs/10.1080/01932691.2011.648498
Intermolecular	Describes the processes which occur between molecules (e.g. attraction, repulsion). Describes the processes which occur within a molecule (e.g. bonding).	http://www.chemguide.co.uk/atoms/bonding/vdw.html http://www.chemguide.co.uk/atoms/bonding/vdw.html
Intravital microscopy	A microscopy technique used for studying living biological specimens at high resolution through an attached window preparation.	http://users.ox.ac.uk/~atdgroup/technicalnotes/Notes%20on%20intravital%20microscopy.pdf
Ion scattering spectroscopy	A beam of ions are targeted onto a material's surface which are scattered by surface atoms, losing energy. The energies of the scattered ions are measured and provide information about the elements present on the surface. This technique is extremely surface sensitive so all surface contamination must be removed.	http://xpssimplified.com/ion_scattering_spectroscopy.php
Ionic bond	A strong electrostatic charge between positive and negative ions.	http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway_pre_2011/periodictable/ionicbondingrev1.shtml
Lipid bilayers	Two layers of fat cells which are common to all cell membranes. The lipds have both water repellant and water attracting components which form two distinct clusters as the layers. The most abundant membrane lipids are the phospholipids.	http://www.bbc.co.uk/education/guides/zydsgk7/revision
Liquid crystals	A material whose properties are between those of a liquid and a solid crystal; i.e. there is some degree of crystal order as a result of self-organisation, despite the material flowing like a liquid. Liquid crystals are used in liquid crystal	http://www.nobelprize.org/educational/physics/liquid_crystals/history/

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	displays (LCDs).	
London dispersion force (LDF)	A weak attractive intermolecular force. It occurs when two neighbouring molecule's electrons are positioned so that they create a temprary dipole. Sometimes called a dipole-induced dipole interaction.	https://www.chem.purdue.edu/gchelp/liquids/disperse.html
Low-energy electron diffraction	A beam of low energy electrons are targeted onto a single crystalline material to measure its surface structure. A diffraction pattern is produced and can be measured to provide information about the symmetry of the arrangement and position of atoms on the surface. Electron diffraction was theoretically discovered in the 1920s by Louis de Broglie, but was not widely used for surface analysis until the 1960s.	http://www.ocivm.com/_low_energy_electron_diffraction.html good animation
Metallic bond	A strong electrostatic bond between positively charged metal ions and negatively charged electrons.	http://hyperphysics.phy-astr.gsu.edu/hbase/chemical/bond.html
Metamaterials	New materials which are designed to have properties not seen in nature. Current technologies use metamaterials to control how light interacts with matter to create 'invisibility cloaks'. For example, a metamaterial surface coating could block all reflected light, controlling what type of light can enter or exit the material. Another example is engineering a material to have a negative refractive index, to create an optical illusion, as seen in the figure.	http://www.iop.org/resources/topic/archive/metamaterials/
Micrometre (µm)	Also known as a micron, a micrometre is one millionth of a meter (10-6).	
Moore's Law	In 1975 Gordon Moore observed that the number of components in an integrated circuit would double every two years, as components reduce in size. This law was used by the semiconductor industry to forecast growth and research and development requirements. In recent years the rate of growth has decreased, Intel have predicted the device number now doubles every two and a half years.	http://www.eng.auburn.edu/~agrawvd/COURSE/E7770_Spr07/READ/Gordon_Moore_1975_Speech.pdf
Nano-enabled product	A product, device or system that has at least one part of it utilising nanotechnology to enhance its functionality. The nano-enabled part may only make up a very small proportion of the overall product in terms of either weight or size or even overall function.	http://www.sciencedirect.com/science/article/pii/S174801321100020X
Nanometre (nm)	A nanometre is one billionth of a meter (10-9m).	http://www.raeng.org.uk/publications/reports/nanoscience-and-nanotechnologies-opportunities
Nanoparticle	Particles that are less than 100m in diameter. In terms of nanotechnology the definition can be further constrained to those particles of less than 100nm scale that exhibit size dependant properties compared to larger particles of the same material. Nanoparticles can be split into three categories a) naturally occurring (such as those that are observed in biology); b) the product of combustion (such as those created during volcanic eruptions or as vehicle engine emissions); c) manufactured nanoparticles (those that have been intentionally created using an engineering process.	http://www.bbc.co.uk/schools/gcsebitesize/science/21c/materials_choices/nanotechnologyrev2.shtml
Nanorod	A nano rod is a solid 2D nano structure with a diameter of up	http://onlinelibrary.wiley.com/

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	to 10nm. These structures usually have a very high length to width ratio. Due to their small diameters, they display some interesting and useful properties that are not usually seen in the bulk material. For example nanorods are used as cancer therapeutics and show potential for use in display screens.	doi/10.1002/adma.201201690/pdf
Nanoscience	The study of phenomena and manipulation of materials at atomic, molecular and macrometer scales, where properties differ significantly from those at a larger scale. Nano is derived from the Greek word for dwarf.	http://www.raeng.org.uk/publications/reports/nanoscience-and-nanotechnologies-opportunities
Nanosheet	Two-dimensional nanostructure with thickness between 1 to 100 nm (e.g. graphene). A typical example of nanosheet is graphene, the thinnest two-dimensional material (0.34 nm) in existence.	https://www.nobelprize.org/nobel_prizes/physics/laureates/2010/advanced-physicsprize2010.pdf
Nanotechnology	The design, characterisation, production and application of structures, devices and systems by controlling shape and size at the nanometer scale. The purposeful engineering of matter at scales of less than 100 nanometres (nm) to achieve size dependent properties and functions.	http://iopscience.iop.org/journal/0957-4484;jsessionid=6DA97255AE9472204818B9AFC7C75638.c1
Nanotube	Nanotubes are a 2 dimensional nanostructure where the diameter of the tube will be no more than 100nm, whilst its length can be longer. Nanotubes are hollow and can be imagined as a nano sheet rolled up. The most commonly known nanotubes are carbon nanotubes, which can be found as either single walled of multi-walled varieties. Nanotubes have a very high length to width ratio.	http://www.nanocomptech.com/what-are-carbon-nanotubes
Nanowires	Structures where the length is much longer than the diameter, which is less than ~10nm and so can be referred to as one dimensional. They have an altered conductivity, and are used in transistors for electric circuits and many other electronics applications.	https://www.sciencedaily.com/terms/nanowire.htm
Photosynthesis	The mechanism whereby plants convert water and carbon dioxide into sugar using solar energy. Oxygen is released in the process.	http://www.bbc.co.uk/education/guides/zpwmxnb/revision
Piezoelectric	Piezoelectric materials are crystals that become charged when distorted (e.g. Quartz crystals). They are commonly used in microphones, speakers, and medical imaging due to the mechanical vibrations that are created following the application of an electrical oscillation to the piezoelectric material.	http://hyperphysics.phy-astr.gsu.edu/hbase/solids/piezo.html http://www.piezomaterials.com/
Quantum confinement	The effect observed in nano-sized structures where the movement of particles such as electrons are restricted by the size of the 'vessel' particle. A quantum dot such as a sphere or prism confines in three dimensions - a quantum wire confines in two dimensions, and a quantum well confines only in one dimension. The electronic and optical properties of materials are affected by both size and shape of the material.	https://www.ttu.ee/public/m/Mehaanikateaduskond/Instituudid/Materjalitehnika_instituut/MTX9100/Lecture13_Nanostructures.pdf
Quantum dot	Typically used to refer to a nano-sized particle in a semiconductor system which is confined in all three dimensions due to quantum effects. They were discovered in	http://folk.uio.no/yurig/Nanotechnology/QD/QD.pdf

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	the 1980s and have a wide range of applications from solar cells to aiding with the imaging of biologocial specimens.	
Quantum Mechanics	Quantum comes from the Latin 'quantus', meaning "how much". Quantum mechanics (or quantum physics or quantum theory) is held to be the departure of classical physics that takes place at very small length scales. At these scales matter behaves very differently than is usually seen at the macro scale. Quantum mechanics allows the understanding and explanation of how matter behaves at these small scales.	http://www.nature.com/news/quantum-physics-what-is-really-real-1.17585 http://www.crystalinks.com/quantumechanics.html
Quantum well	A thin (5-20 nm) layer where particles are confined in one dimension (perpendicular to the layer) due to quantum effects, but not in the other two dimensions (across the layer). Quantum wells are in wide use in diode lasers, including red lasers for DVDs and laser pointers	https://www.rp-photonics.com/quantum_wells.html
Raman spectroscopy	A laser beam is focused on the surface of a material which is scattered from the surface molecules. The scattered light is made up of different frequencies which are measured and provide information about the type and bonding of atoms on the surface of the material as well as crystal size. Raman spectroscopy was first discovered in the late 1920s.	http://www.inphotonics.com/raman.htm http://hyperphysics.phy-astr.gsu.edu/hbase/atmos/raman.html#c1
Reflection absorbed infrared	Surface molecules vibrate, and if they are "dipole charged" (one end is positive and the other negative) they can absorb infrared light. In reflection absorbed infrared spectroscopy, infrared light is focused onto the surface the reflected light is measured. The light absorbed by the dipole molecules will not be reflected so absorption peaks in the measured spectrum provide information about the types of molecules present on the surface.	http://www.chem.qmul.ac.uk/surfaces/scc/scat5_4.htm http://www.astrochemistry.hw.ac.uk/rairs.html
Refraction	The change in direction of a wave when it passes through a material which changes its speed. For example when light bends on passing through glass. The change in the speed of the wave is measured by the refractive index of the material. For glass this is 1.52.	hyperphysics.phy-astr.gsu.edu/hbase/geoopt/refr.html
Risk	Risk [...] takes the probability and the scale of damage into account that a harmful event will occur. The decisive factor is the weighing of the possible scale of damage with the probability of exposure and the related harm. Thus, risk is deemed to be the probability of the occurrence of a harmful event.	Scheer, Dirk et al.: "The Distinction Between Risk and Hazard: Understanding and Use in Stakeholder Communication". Risk Analysis, Vol. 34, No. 7, 2014, pp.1271. Bundesinstitut für Risikobewertung (BfR). Questions and Answers on Nanotechnology, Updated FAQ of 28 August 2012.
Risk acceptance	Risk acceptance is related to the approval of risk decisions or risk communication.	Ruhrmann, Georg: Risiko und Risikokommunikation. R. Fröhlich et al. (Hrsg.): Handbuch der Public Relations, Wiesbaden 2015, pp. 986
Risk analysis	Process consisting of three interconnected components: risk assessment, risk management and risk communication.	Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002
Risk assessment	Scientifically based process consisting of four steps: hazard identification, hazard characterisation, exposure assessment and risk characterisation	Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002
Risk communication	Interactive exchange of information and opinions	Regulation (EC) No 178/2002 of the

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	throughout the risk analysis process as regards hazards and risks, risk-related factors and risk perceptions, among risk assessors, risk managers, consumers, feed and food businesses, the academic community and other interested parties, including the explanation of risk assessment findings and the basis of risk management decisions.	European Parliament and of the Council of 28 January 2002
Risk management	Process, distinct from risk assessment, of weighing policy alternatives in consultation with interested parties, considering risk assessment and other legitimate factors, and, if need be, selecting appropriate prevention and control options.	Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002
Risk perception	Subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences. [...] Risk perception goes beyond the individual, and it is a social and cultural construct reflecting values, symbols, history, and ideology (Weinstein 1989).	Sjöberg, Lennart et al. Explaining risk perception. An evaluation of the psychometric paradigm in risk perception research. 2004.
Secondary ion mass spectroscopy	A beam of ions are targeted onto a material's surface which causes particles (ions) from the surface to be ejected. These are called secondary ions. The mass/charge ratios of the secondary ions are measured and provide information about the elements present on the surface. This technique extremely surface sensitive can provide information about the top 1-2nm of a material. As for self-organisation. Molecular self-assembly is the case where the components are individual molecules. Self-assembly can be classified as either static or dynamic. In static self-assembly, the ordered state forms as a system approaches equilibrium, reducing its free energy. However, in dynamic self-assembly, patterns of pre-existing components organized by specific local interactions are not commonly described as "self-assembled" by scientists in the associated disciplines. These structures are better described as "self-organized". Self-organization is a process where some form of overall order or coordination arises out of the local interactions between smaller component parts of an initially disordered system. The process of self-organization can be spontaneous, and it is not necessarily controlled by any auxiliary agent outside of the system.	http://link.springer.com/article/10.1007%2Fs10853-006-6568-x
Self assembly	Self-assembly is a type of process in which a disordered system of pre-existing components (possibly formed by self organisation) forms an organized structure or pattern as a consequence of specific, local interactions among the components themselves, without external direction. In terms of nano-architecture, self assembly occurs at a larger scale than self organisation.	http://www.selfassemblylab.net/
Self organisation	Self-organisation processes are where molecules or nano-sized particles spontaneously adopt an overall structure as a result of the local interactions within the initially disordered system. These assemblies are often able to survive and self-repair substantial damage or perturbations.	
SEM (Scanning electron microscope)	First developed in 1937 and available commercially from 1965, this type of electron microscope produces images of a sample by scanning it with a focused beam of electrons. The electrons interact with atoms in the sample, producing various signals that can be detected and that contain information about the sample's surface topography and composition. It can achieve resolution better than	http://virtual.itg.uiuc.edu/training/EM_tutorial/

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	1nm; much higher than optical microscopes due to the wavelength of the electrons being much smaller than that of visible light photons. There are many variants which can give additional information on chemical and physical structure.	
Surfaces and surface phenomena	As the size of a system decreases into the nanoscale the ratio of surface area to volume dramatically increases and the system becomes dominated by the surface and the surface properties rather than the bulk (as in normal systems).	
TEM (Transmission electron microscope)	First constructed in 1931, this is a type of microscopy technique in which a beam of electrons is transmitted through an extremely thin specimen, interacting with the specimen as it moves through it, so generating an image. Can be combined with other analytical techniques to determine information on chemical and physical structure.	http://www.matter.org.uk/tem/
TEM (Transmission Electron Microscope) holography	A high resolution three dimensional imaging technique usually used to study electric and magnetic fields in thin films using a tranmission electron microscope.	http://www.nature.com/nmat/journal/v8/n4/full/nmat2406.html
The electromagnetic force	One of the four fundamental forces, the electromagnetic force occurs between charged particles. It holds atoms and molecules together against the repulsion of protons.	http://hyperphysics.phy-astr.gsu.edu/hbase/forces/funfor.html
The strong force	One of the four fundamental forces, the strong force is short range and holds an atomic nucleus together, against the repulsion of protons.	http://hyperphysics.phy-astr.gsu.edu/hbase/forces/funfor.html
Thermal desorption spectroscopy	A surface analysis technique based on changes in surface temperature. When a surface is heated, molecules bonded to the surface will desorb (opposite of adsorb). The temperature at which the molecule desorbs is dependent on its binding energy, which is related to its mass.	http://www.fhi-berlin.mpg.de/acnew/department/pages/teaching/pages/teaching__wintersemester__2011_2012/dirk_rosenthal__thermal_desorption_spectroscopy__120113.pdf
Top down	Top down is the second way in which nanomaterials can be created. In this process, material is carved away form a larger structure to make a nanomaterial. An example of this is the manufacture of nanoparticles using a mechanical manufacturing method such as milling, where larger particles of material are ground down to make smaller and smaller particles.	http://onlinelibrary.wiley.com/doi/10.1002/9780470661345.smc195/abstract;jsessionid=C8DE30E08C40DC074308E107F2F43B2A.f02t02 http://www.nano.gov/nanotech-101/what/manufacturing
Topography	The shape of a surface. AFM can be used to measure the topography at very high resolution and provide surface maps and information about surface features. A Scanning electron microscope (SEM) can also be used to measure topography.	http://www.eng.utah.edu/~lzang/images/Lecture_10_AFM.pdf
Transistor	Transistors are used as switches or amplifiers to control electric signals. They are made of solid semiconductor material and are extremely small; thousands can be connected in a circuit and cover just 1mm2.	http://www.bbc.co.uk/schools/gcsebitesize/design/electronics/switchesrev3.shtml http://hyperphysics.phy-astr.gsu.edu/hbase/solids/trans.html http://www.nobelprize.org/educational/physics/transistor/
Tribology	The study of surfaces in motion including the understanding of friction, wear and lubrication. High wear surfaces in different environments such as combustion engines and hip	http://www.imperial.ac.uk/tribology

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	replacements can be improved with the addition of nano-materials to the lubricant.	
Uncertainty analysis	The objective of uncertainty analysis is to increase transparency of exposure assessment. This includes the characterisation of the objective of the assessment, the terms of reference and the description of the definition of the aims of the protection. Deficits in knowledge, models and parameters must be characterized appropriately.	Bundesinstitut für Risikobewertung (BfR). Questions and Answers on Nanotechnology, Updated FAQ of 28 August 2012.
Van der Waals forces	An intermolecular force which includes attraction and repulsions between atoms, molecules, and surfaces, as well as other intermolecular forces such as induction and the London dispersion force. These forces are distinct from both covalent and ionic bonds and are generally weaker than these types of bond. Geckos use van der Waals forces to stick on surfaces through interactions between the surface and nanosized hairs on their feet.	http://hyperphysics.phy-astr.gsu.edu/hbase/chemical/waal.html http://www.chemguide.co.uk/atoms/bonding/vdw.html
Wave interference	When two waves meet, they interfere with each other to produce a higher amplitude (constructive interference) or lower amplitude (destructive interference) signal.	http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/dslit.html#c1
Wave-particle duality	When travelling close to the speed of light, particles such as electrons, are considered to behave like a wave so that a beam of high speed particles can be focused and scattered in the same way light is.	http://chemistry.tutorvista.com/nuclear-chemistry/wave-particle-duality.html
XPS (X-ray photoelectron spectroscopy)	First developed in 1907, XPS can measure the elemental composition of a surface (up to 10nm thick). A material is subject to a focused beam of x-rays which interacts with the material's surface, emitting electrons of varying energy. Each element produces electrons of certain energies, which can be detected and appear as peaks in the XPS spectrum. By analysing the collection of peaks in a spectrum, the elements present in the material can be identified.	Young and Freedman, University Physics with Modern Physics, 12th edition. (2007) http://www.chm.bris.ac.uk/pt/diamond/jamespthesis/chapter2.htm