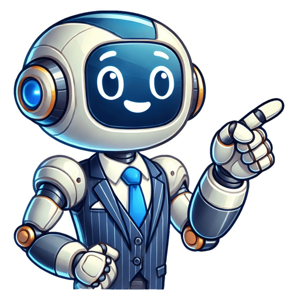

Physics is the study of matter and energy and how they interact in our universe.Physics uses experiments to create laws that help us understand and predict natural phenomena.Studying physics is important because it helps answer fundamental questions about our physical universe. Physics is the scientific study of matter and energy and how they interact with each other.This energy can take the form of motion, light, electricity, radiation, gravity just about anything, honestly. Physics deals with matter on scales ranging from sub-atomic particles (i.e. the particles that make up the atom and the particles that make up those particles) to stars and even entire galaxies. As an experimental science, physics utilizes the scientific method to formulate and test hypotheses that are based on observation of the natural world. The goal of physics is to use the results of these experiments to formulate scientific laws, usually expressed in the language of mathematics, which can then be used to predict other phenomena. When you talk about theoretical physics, you are speaking of the area of physics that is focused on developing these laws and using them to extrapolate into new predictions. These predictions from theoretical physicists then create new questions that experimental physicists then develop experiments to test. In this way, the theoretical and experimental components of physics (and science in general) interact with each other and push each other forward to develop new areas of knowledge. In a broader sense, physics can be seen as the most fundamental of the natural sciences. Chemistry, for example, can be viewed as a complex application of physics, as it focuses on the interaction of energy and matter in chemical systems. We also know that biology is, at its heart, an application of chemical properties in living things, which means that it is also, ultimately, ruled by the physical laws. Of course, we don't think of these other fields as part of physics. When we investigate something scientifically, we look for patterns at the scale that is most appropriate. Though every living thing is acting in a way that is fundamentally driven by the particles of which it is composed, trying to explain an entire ecosystem in terms of the behavior of fundamental particles would be diving into an unhelpful level of detail. Even when looking at the behavior of a liquid, we look in general at the properties of the fluid as a whole through fluid dynamics, rather than paying particular attention to the behavior of the individual particles. Because physics covers so much area, it is divided into several specific fields of study, such as electronics, quantum physics, astronomy, and biophysics. Physics includes the study of astronomy, and in many ways, astronomy was humanity's first organized field of science. Ancient peoples looked to the stars and recognized patterns there, then began using mathematical precision to make predictions about what would happen in the heavens based on those patterns. Whatever flaws there were in these specific predictions, the method of trying to understand the unknown was a worthy one. Trying to understand the unknown is still a central problem in human life. Despite all of our advancements in science and technology, being a human being means that you are able to understand some things and also that there are things you do not understand. Science teaches you a methodology for approaching the unknown and asking questions that get to the heart of what is unknown and how to make it known. Physics, in particular, focuses on some of the most fundamental of questions about our physical universe. Pretty much the only more fundamental questions that could be asked fall in the philosophical realm of "metaphysics" (named for being literally "beyond physics'), but the problem is that these questions are so fundamental that many of the questions in the metaphysical realm remain unresolved even after centuries or millennia of inquiry by most of history's greatest minds. Physics, on the other hand, has resolved many fundamental issues, even though those resolutions tend to open up whole new types of questions. For more on this subject, check out "Why Study Physics?" (adapted, with permission, from the book Why Science? by James Trefil). mineral processing Mineral processing, art of treating crude ores and mineral products in order to separate the valuable minerals from the waste rock, or gangue. It is the first process that most ores undergo after mining... relativity Relativity, wide-ranging physical theories formed by the German-born physicist Albert Einstein. With his theories of special relativity (1905) and general relativity (1915), Einstein overthrew many assumptions... mechanics of solids Mechanics of solids, science concerned with the stressing, deformation, and failure of solid materials and structures. What, then, is a solid? Any material, fluid or solid, can support normal forces. These... ultrasonics Ultrasonics, vibrations of frequencies greater than the upper limit of the audible range for humansthat is, greater than about 20 kilohertz. The term sonic is applied to ultrasound waves of very high... light Light, electromagnetic radiation that can be detected by the human eye. Electromagnetic radiation occurs over an extremely wide range of wavelengths, from gamma rays with wavelengths less than about 1... sound reception Sound reception, response of an organisms aural mechanism, the ear, to a specific form of energy change, or sound waves. Sound waves can be transmitted through gases, liquids, or solids, but the hearing... principles of physical science Principles of physical science, the procedures and concepts employed by those who study the inorganic world. Physical science, like all the natural sciences, is concerned with describing and relating to... fluid mechanics Fluid mechanics, science concerned with the response of fluids to forces exerted upon them. It is a branch of classical physics with applications of great importance in hydraulic and aeronautical engineering,... gravity Gravity, in mechanics, the universal force of attraction acting between all bodies of matter. It is by far the weakest known force in nature and thus plays no role in determining the internal properties... mirror Mirror, any polished surface that diverts a ray of light according to the law of reflection. The typical mirror is a sheet of glass that is coated on its back with aluminum or silver that produces images... cosmology Cosmology, field of study that brings together the natural sciences, particularly astronomy and physics, in a joint effort to understand the physical universe as a unified whole. The observable universe... liquid Liquid, in physics, one of the three principal states of matter, intermediate between gas and crystalline solid. The most obvious physical properties of a liquid are its retention of volume and its conformation... heat Heat, energy that is transferred from one body to another as the result of a difference in temperature. If two bodies at different temperatures are brought together, energy is transferredi.e., heat flowsfrom... physics Physics, science that deals with the structure of matter and the interactions between the fundamental constituents of the observable universe. In the broadest sense, physics (from the Greek physikos) is... seismograph Seismograph, instrument that makes a record of seismic waves caused by an earthquake, explosion, or other Earth-shaking phenomenon. Seismographs are equipped with electromagnetic sensors that translate... geomagnetic field Geomagnetic field, magnetic field associated with Earth. It is primarily dipolar (i.e., it has two poles, the geomagnetic North and South poles) on Earths surface. Away from the surface the dipole becomes... mechanics Mechanics, science concerned with the motion of bodies under the action of forces, including the special case in which a body remains at rest. Of first concern in the problem of motion are the forces that... acoustics Acoustics, the science concerned with the production, control, transmission, reception, and effects of sound. The term is derived from the Greek akoustos, meaning heard. Beginning with its origins in... relativistic mechanics Relativistic mechanics, science concerned with the motion of bodies whose relative velocities approach the speed of light c, or whose kinetic energies are comparable with the product of their masses m... holography Holography, means of creating a unique photographic image without the use of a lens. The photographic recording of the image is called a hologram, which appears to be an unrecognizable pattern of stripes... metallurgy Metallurgy, art and science of extracting metals from their ores and modifying the metals for use. Metallurgy customarily refers to commercial as opposed to laboratory methods. It also concerns the chemical,... lubrication Lubrication, introduction of any of various substances between sliding surfaces to reduce wear and friction. Nature has been applying lubrication since the evolution of synovial fluid, which lubricates... quantum mechanics Quantum mechanics, science dealing with the behaviour of matter and light on the atomic and subatomic scale. It attempts to describe and account for the properties of molecules and atoms and their constituentselectrons,... scanning tunneling microscope Scanning tunneling microscope (STM), type of microscope whose principle of operation is based on the quantum mechanical phenomenon known as tunneling, in which the wavelike properties of electrons permit... biophysics Biophysics, discipline concerned with the application of the principles and methods of physics and the other physical sciences to the solution of biological problems. The relatively recent emergence of... physical science Physical science, the systematic study of the inorganic world, as distinct from the study of the organic world, which is the province of biological science. Physical science is ordinarily thought of as... multiverse Multiverse, a hypothetical collection of potentially diverse observable universes, each of which would comprise everything that is experimentally accessible by a connected community of observers. The observable... microscope Microscope, instrument that produces enlarged images of small objects, allowing the observer an exceedingly close view of minute structures at a scale convenient for examination and analysis. Although... electronics Electronics, branch of physics and electrical engineering that deals with the emission, behaviour, and effects of electrons and with electronic devices. Electronics encompasses an exceptionally broad range... anthropic principle Anthropic principle, in cosmology, any consideration of the structure of the universe, the values of the constants of nature, or the laws of nature that has a bearing upon the existence of life. Clearly,... atomic physics Atomic physics, the scientific study of the structure of the atom, its energy states, and its interactions with other particles and with electric and magnetic fields. Atomic physics has proved to be a... radioactivity Radioactivity, property exhibited by certain types of matter of emitting energy and subatomic particles spontaneously. It is, in essence, an attribute of individual atomic nuclei. An unstable nucleus will... thermodynamics Thermodynamics, science of the relationship between heat, work, temperature, and energy. In broad terms, thermodynamics deals with the transfer of energy from one place to another and from one form to... optics Optics, science concerned with the genesis and propagation of light, the changes that it undergoes and produces, and other phenomena closely associated with it. There are two major branches of optics,... gas Gas, one of the three fundamental states of matter, with distinctly different properties from the liquid and solid states. The remarkable feature of gases is that they appear to have no structure at all.... plasma Plasma, in physics, an electrically conducting medium in which there are roughly equal numbers of positively and negatively charged particles, produced when the atoms in a gas become ionized. It is sometimes... celestial mechanics Celestial mechanics, in the broadest sense, the application of classical mechanics to the motion of celestial bodies acted on by any of several types of forces. By far the most important force experienced... solid Solid, one of the three basic states of matter, the others being liquid and gas. (Sometimes plasma, or ionized gases, are considered a fourth state of matter.) A solid forms from liquid or gas because... lens Lens, in optics, piece of glass or other transparent substance that is used to form an image of an object by focusing rays of light from the object. A lens is a piece of transparent material, usually circular... sound Sound, a mechanical disturbance from a state of equilibrium that propagates through an elastic material medium. A purely subjective definition of sound is also possible, as that which is perceived by the... string theory String theory, in particle physics, a theory that attempts to merge quantum mechanics with Albert Einsteins general theory of relativity. The name string theory comes from the modeling of subatomic particles... electron microscope Electron microscope, microscope that attains extremely high resolution using an electron beam instead of a beam of light to illuminate the object of study. Fundamental research by many physicists in the... colour Colour, the aspect of any object that may be described in terms of hue, lightness, and saturation. In physics, colour is associated specifically with electromagnetic radiation of a certain range of wavelengths... Physics is the most basic discipline in the field of Natural Sciences, which also includes other disciplines, such as chemistry and biology. The word Physics comes from a Greek word Fusis which means nature. An ancient Greek philosopher Aristotle introduced this word in the year 350 B.C. In the Sanskrit language, the meaning of physics is Bhautiki that refers to the study of the physical world.A precise definition of this discipline is as:Physics is a fundamental branch of science that deals with the study of nature and natural phenomenon. In other words, physics is a branch of science that studies the basic laws of nature and their manifestation in different natural phenomena. Physics is the backbone of study of life as well as the strength of all other branches of natural science. The fundamental goal of physics is to look for and understand the basic laws of nature on which all the physical phenomena depend.Physics studies about how things work, and why things occur the way they do. For example, physics explains aboutWhy does a teaspoon gets hot when it is in the cup of tea?What is the universe made of and how does work?Why sky is blue?Why are rainbows having colors?What atoms and nuclei are made of?Physics explains the answers to all these and many more questions related to life, the universe, and everything in the world using basic laws and fundamental principles. One who studies physics is called a physicist.The creator of the universe has given us things in two forms: matter and energy. Matter refers to anything that occupies space and has mass. It is the material that builds up the physical world around us. It can occur in various states, such as solid, liquid, gas, and plasma, depending on the arrangement and motion of its constituent particles.Everything which is not material in nature like light, heat, sound, waves, etc. are called energy. Thus, we can say that Physics is the branch of natural science that studied about matter and energy and their interconversion.Physics plays a vital role in all the sectors for sustainable growth of the globe. There are the following sectors from which we may link to the physics. They are as:HealthEnergyTechnologyEnvironmentCommunicationBioscienceSpace scienceEducationTransportMeteorologyEntertainment and many moreLets understand a few of them one by one with the help of example.Health:Physics plays a significant role in understanding and improving various aspects of health and medicine. It has revolutionized medical diagnosis, treatment, and research, making better healthcare. The cure of many diseases is possible by new innovative methods like the use of X-rays, laser, spectrometers, ultrasound, computed tomography (CT), etc. Physics plays an important duty in radiation oncology, where high-energy radiation is used to treat cancer.Energy:It is said that energy is the lifeline of the society. Physics is the major contributor to this sector. It discovered all forms of energy, whether conventional or non-conventional energy. Solar energy, wind energy, and geothermal energy will replace conventional forms in the new millennium. Development of solar cells, wind mills, etc. are the main contributors in this field.Communication:Physics plays a vital role in the field of communication network. Development of mobile phones, computer, fax, audio and video transmission and reception, internet services, etc. have made communication both useful and fast.Bioscience:Physics has added a new dimension to the study of bioscience. The use of spectrometer, ultrasound, X-rays, EMR, ESR, and MRI have transformed the face of bioscience.Space science:The study of physics only made it possible for the launching of rockets, satellites, and all different kinds of space crafts.There are two principal thrusts in physics. They are as:We use both of these principles in Physics. So, lets understand it one by one with example.(1) Unification: The word unify means reduce to unity. The process of uniting is called unification. In physics, it is possible to explain different physical phenomena (which are not similar in nature) in terms of a few concepts and laws. For example, the law of gravitational force given by Newton states the force of attraction between two material bodies.The same law can be used to describe the free fall of an apple to the ground, the motion of the moon around the earth, the motion of planets around the sun, or the motion of an electron around the nucleus of an atom.Similarly, the basic laws of electromagnetism (Maxwells equations) explain most of the electric and magnetic phenomena. The ultimate attempt of physics is to unify all the fundamental forces of nature into unity. Here, we are attempting to say that all the available forces in nature are children of a single mother force and this theory is known as unified field theory.(2) Reductionism: The analyzing more complex things in terms of its simple constituents is called reductionism and is the heart of physics. Lets understand it with the help of an example. Microscopic quantities such as pressure, volume, temperature, etc. explain the state of a gas. We know the gas equation PV = RT, where R is a universal gas constant. We can also express the pressure P of the gas in terms of motion of molecules of gas as P = 2/ 3. In this formula, 2 is the mean square velocity of the molecule, which is microscopic quantity. This way of expressing a microscopic quantity (pressure of gas) in terms of a microscopic quantity (velocity of molecule) is called reductionism.The extent of knowledge available on physics is so broad. Thats why, as a matter of convenience, it has been divided into two categories. They are:Classical (old) physicsModern physics(a) Classical physics: The physics prior to 1890 is considered as classical physics. It includes the study of mechanics, gravitation, heat, sound, light, electricity, and magnetism. The law of motion and gravitation given by Newton had provided a solid foundation of mechanics to the impressive height.The four laws of thermodynamics and kinetic theory of matter had provided a satisfactory explanation in understanding of energy conservation and the direction of heat flow. James Clerk Maxwell gave the theory of electromagnetic radiation and described all electrical, magnetic, and optical phenomena.Classical physics cannot work with microscopic particles (e.g. atoms) or objects travelling at very high speed. Therefore, modern physics comes into the existence. However, classical physics correctly and precisely explained the behaviour of the physical world except for the microscopic particles and objects travelling near the speed of light.(b) Modern Physics: The physics after 1890 is considered as modern physics. It deals with the study of quantum mechanics, relativity, atoms, nuclei, elementary particles like electron, proton, and condensed matter. After 1900, there had been tremendous advances in physics, which gave birth the several new concepts. Roentgen discovered X-rays in 1895.A few weeks later, Henry discovered the radioactivity. In the year 1897, a professor of physics at the University of Cambridge in England, J.J. Thomson discovered the first subatomic particle called electron. In 1901, Max Planck gave the quantum theory. This theory states that energy is not radiated continuously, but in discrete packets of energy called a quanta. Eventually, these quanta came to be known as photons.In 1905, Albert Einstein proposed a special theory of relativity which gave a new concept to atomic and nuclear physics. In short, the discovery of new theory in the modern physics, after 1890, gave several new concepts to the entire physics.We know that physics is a basic science that tells about the nature of basic things, such as motion, force, energy, matter, light, sound, heat, and the inside of atoms. Apprehension of science starts with the understanding of physics. In this section, we will understand how physics is related to other science subjects.(1) Physics and Mathematics: We have seen that physics depends of the experimental observations and quantitative measurements. Once we have measured, we need mathematics to express the quantity. The laws of physics are usually expressed as mathematical equations. Therefore, we require a considerable knowledge of mathematics. This shows that physics and mathematics are very closely related.(2) Physics and Chemistry: The branch of science, chemistry tells how atoms combine to form molecules and how molecules combine to make up the many kinds of matter around us. In order to describe these concepts, we will have to apply the laws and theories of physics. Eventually, it reveals us how physics is related to chemistry.(3) Physics and Biology: Biology is more complex because it involves matters that are alive. Biological studies are impossible without a microscope invented by the aid of physics. The discovery of radioactivity, X-rays, etc. in physics has cured the number of diseases by improving the method of diagnosis. Without inventions of some electronic equipments like amplifiers, cathode-ray oscillograph, etc. ECG (Electrocardiogram), EEG (Electro Encephalogram) and EMG (Electromyogram) would have been just impossible.(4) Physics and Other Sciences: As physics is a fundamental of natural science, its laws and theories are applied to explain various concepts, processes in biophysics, meteorology, geophysics, oceanography, material science, etc.Both physics and technology differ from each other. Physics provides the knowledge of material universe, whereas technology transfers the knowledge of physics into practical use. For example, physics has offered the knowledge of semiconductors, but technology used it to build up transistor, diodes, IC, LED, etc. Several technologies have been developed based on the knowledge of physics. A few of them are mentioned below:Link between technology and physics:TechnologyScientific Principle(s)1. AeroplaneBernoullis principle in fluid dynamics2. ComputersDigital logic3. Electric generator, electric motor, transformerFaradays law of electromagnetic induction4. Electron microscopeWave nature of electrons5. Steam engineLaws of thermodynamics6. Hydroelectric powerConversion of gravitational potential energy into electric energy7. LasersLight amplification by stimulated emission of radiation8. Nuclear reactorControlled nuclear fission9. Optical fibresTotal internal reflection of light10. Particle acceleratorsMotion of charged particles in electromagnetic fields11. PhotocellPhotoelectric effect12. Radio and televisionGeneration, propagation, and detection of electromagnetic13. Rocket propulsionNewtons law of motion14. SonarReflection of ultrasonic waves15. Non-reflecting coatingsThin film optical interferenceThe above list of table shows that how the knowledge of physics is important in developing new technologies.The discoveries of laws and theories of physics have made the technologies advanced. The advancement of technology completely changed the human lives. For example, we travel faster than ever before in aeroplanes, use electricity to operate numerous electrical appliances, solve complex problems at amazing speed using computers, and many more. Thus, physics set the future of human society.In this tutorial, we have discussed the definition of physics, its roles in different sectors, classification, and relation with other sciences. Hope that you will have understood the basic points and enjoyed this tutorial.Thanks for reading!!! Science Physics physics, science that deals with the structure of matter and the interactions between the fundamental constituents of the observable universe. In the broadest sense, physics (from the Greek physikos) is concerned with all aspects of nature on both the macroscopic and submicroscopic levels. Its scope of study encompasses not only the behaviour of objects under the action of given forces but also the nature and origin of gravitational, electromagnetic, and nuclear force fields. Its ultimate objective is the formulation of a few comprehensive principles that bring together and explain all such disparate phenomena.(Read Einsteins 1926 Britannica essay on space-time.)Physics is the basic physical science. Until rather recent times physics and natural philosophy were used interchangeably for the science whose aim is the discovery and formulation of the fundamental laws of nature. As the modern sciences developed and became increasingly specialized, physics came to denote that part of physical science not included in astronomy, chemistry, geology, and engineering. Physics plays an important role in all the natural sciences, however, and all such fields have branches in which physical laws and measurements receive special emphasis, bearing such names as astrophysics, geophysics, biophysics, and even psychophysics. Physics can, at base, be defined as the science of matter, motion, and energy. Its laws are typically expressed with economy and precision in the language of mathematics.Both experiment, the observation of phenomena under conditions that are controlled as precisely as possible, and theory, the formulation of a unified conceptual framework, play essential and complementary roles in the advancement of physics. Physical experiments result in measurements, which are compared with the outcome predicted by theory. A theory that reliably predicts the results of experiments to which it is applicable is said to embody a law of physics. However, a law is always subject to modification, replacement, or restriction to a more limited domain, if a later experiment makes it necessary.The ultimate aim of physics is to find a unified set of laws governing matter, motion, and energy at small (microscopic) subatomic distances, at the human (macroscopic) scale of everyday life, and out to the largest distances (e.g., those on the extragalactic scale). This ambitious goal has been realized to a notable extent. Although a completely unified theory of physical phenomena has not yet been achieved (and possibly never will be), a remarkably small set of fundamental physical laws appears able to account for all known phenomena. The body of physics developed up to about the turn of the 20th century, known as classical physics, can largely account for the motions of macroscopic objects that move slowly with respect to the speed of light and for such phenomena as heat, sound, electricity, magnetism, and light. The modern developments of relativity and quantum mechanics modify these laws insofar as they apply to higher speeds, very massive objects, and to the tiny elementary constituents of matter, such as electrons, protons, and neutrons. How Much Do You Know About Physics? The traditionally organized branches or fields of classical and modern physics are delineated below. Mechanics is generally taken to mean the study of the motion of objects (or their lack of motion) under the action of given forces. Classical mechanics is sometimes considered a branch of applied mathematics. It consists of kinematics, the description of motion, and dynamics, the study of the action of forces in producing either motion or static equilibrium (the latter constituting the science of statics). The 20th-century subjects of quantum mechanics, crucial to treating the structure of matter, subatomic particles, superfluidity, superconductivity, neutron stars, and other major phenomena, and relativistic mechanics, important when speeds approach that of light, are forms of mechanics that will be discussed later in this section. In classical mechanics the laws are initially formulated for point particles in which the dimensions, shapes, and other intrinsic properties of bodies are ignored. Thus in the first approximation even objects as large as Earth and the Sun are treated as pointlike.e.g., in calculating planetary orbital motion. In rigid-body dynamics, the extension of bodies and their mass distributions are considered as well, but they are imagined to be incapable of deformation. The mechanics of deformable solids is elasticity; hydrostatics and hydrodynamics treat, respectively, fluids at rest and in motion. The three laws of motion set forth by Isaac Newton form the foundation of classical mechanics, together with the recognition that forces are directed quantities (vectors) and combine accordingly. The first law, also called the law of inertia, states that, unless acted upon by an external force, an object at rest remains at rest, or if in motion, it continues to move in a straight line with constant speed. Uniform motion therefore does not require a cause. Accordingly, mechanics concentrates not on motion as such but on the change in the state of motion of an object that results from the net force acting upon it. Newtons second law equates the net force on an object to the rate of change of its momentum, the latter being the product of the mass of a body and its velocity. Newtons third law, that of action and reaction, states that when two particles interact, the forces each exerts on the other are equal in magnitude and opposite in direction. Taken together, these mechanical laws in principle permit the determination of the future motions of a set of particles, providing their state of motion is known at some instant, as well as the forces that act between them and upon them from the outside. From this deterministic character of the laws of classical mechanics, profound (and probably incorrect) philosophical conclusions have been drawn in the past and even applied to human history. Lying at the most basic level of physics, the laws of mechanics are characterized by certain symmetry properties, as exemplified in the aforementioned symmetry between action and reaction forces. Other symmetries, such as the invariance (i.e., unchanging form) of the laws under reflections and rotations carried out in space, reversal of time, or transformation to a different part of space or to a different epoch of time, are present both in classical mechanics and in relativistic mechanics, and with certain restrictions, also in quantum mechanics. The symmetry properties of the theory can be shown to have as mathematical consequences basic principles known as conservation laws, which assert the constancy in time of the values of certain physical quantities under prescribed conditions. The conserved quantities are the most important ones in physics; included among them are mass and energy (in relativity theory, mass and energy are equivalent and are conserved together), momentum, angular momentum, and electric charge. Physics is the fundamental science that seeks to understand the laws governing matter, energy, and the fundamental forces of nature. As one of the oldest scientific disciplines, physics aims to answer fundamental questions about the universe, from the smallest subatomic particles to the vastness of galaxies. By studying physics, scientists develop insights that lead to technological advancements, from medical imaging devices to space exploration tools. Physics is the branch of science that studies matter, energy, and their interactions through space and time. It seeks to understand the laws that govern the behavior of the physical universe. Physics explores concepts such as motion, force, energy, time, and space, often using mathematical models to describe these phenomena. Key Areas in Physics: Matter: The study of the composition, structure, and properties of substances. Energy: Analysis of different forms of energy, including kinetic, potential, thermal, and electromagnetic. Fundamental Forces: Investigation of gravitational, electromagnetic, weak nuclear, and strong nuclear forces. Physics is essential for understanding the natural world and drives scientific and technological innovations that impact daily life. Knowledge from physics helps develop various applications in fields such as engineering, medicine, electronics, and environmental science. Physics encompasses several branches, each focusing on different aspects of the natural world. Here are some major branches: Definition: Classical physics deals with the macroscopic laws of motion, force, and energy, typically within contexts that dont require quantum or relativistic explanations. Key Areas:Mechanics: Studies motion and forces in systems (e.g., Newtons laws). Thermodynamics: Examines heat, work, and energy transfer. Electromagnetism: Explores electric and magnetic fields and their interactions. Applications: Engineering, mechanics, automotive industry, and thermal systems.Definition: Quantum physics explores the behavior of particles at atomic and subatomic scales, where classical physics no longer applies. Key Areas:Quantum Mechanics: Studies the behavior of particles like electrons and photons. Quantum Field Theory: Explains how particles interact at the quantum level. Quantum Computing: Applies quantum principles to develop advanced computing systems. Applications: Semiconductors, lasers, MRI technology, and quantum computing.Definition: Relativistic physics is based on Albert Einsteins theory of relativity, which addresses how space, time, and motion interact at high speeds. Key Areas:Special Relativity: Focuses on objects moving at constant speeds, especially close to the speed of light. General Relativity: Extends the theory to include gravity, describing it as the curvature of space-time. Applications: GPS systems, astrophysics, and particle physics.Definition: Nuclear physics studies the components and interactions of atomic nuclei, exploring phenomena like nuclear reactions, fission, and fusion. Key Areas:Nuclear Energy: Harnessing energy through fission or fusion. Radioactivity: Studying the decay of unstable atomic nuclei. Applications: Nuclear power, medical imaging, radiation therapy, and nuclear weapons.Definition: Astrophysics applies the principles of physics to study celestial bodies and phenomena beyond Earths atmosphere. Key Areas:Cosmology: Studies the origin, structure, and evolution of the universe. Stellar Physics: Examines the lifecycle of stars, black holes, and galaxies. Applications: Space exploration, telescopes, satellites, and planetary science.Definition: Condensed matter physics examines the physical properties of matter in solid and liquid states. Key Areas:Solid-State Physics: Focuses on the properties of solids, such as crystals and metals. Superconductivity: Studies materials that conduct electricity with zero resistance at very low temperatures. Applications: Electronics, superconductors, nanotechnology, and materials science.Definition: Biophysics applies the principles of physics to study biological systems and processes. Key Areas:Molecular Biophysics: Examines the structure and function of biological molecules. Biomechanics: Studies the mechanics of body movements and structures. Applications: Medical devices, imaging technologies, and biomolecular research.Definition: Geophysics is the study of Earths physical properties and processes using physical principles. Key Areas:Seismology: The study of earthquakes and seismic waves. Volcanology: Investigates the physics of volcanic activity. Applications: Earthquake prediction, mineral exploration, and environmental science. Physicists use various methods to conduct research, gather data, test hypotheses, and validate theories. These methods range from theoretical work and mathematical modeling to experimental approaches. Definition: Theoretical modeling involves using mathematical equations and models to predict or describe physical phenomena. Approach:Develop mathematical models that represent physical systems. Use equations to predict outcomes or derive laws, such as Newtons laws of motion or Schrdingers equation in quantum mechanics. Example: Theoretical physicists might use models to predict the behavior of particles in a quantum field.Definition: Experimental methods involve conducting controlled experiments to observe and measure physical phenomena and validate theories. Approach:Design experiments that isolate variables and control conditions to test hypotheses. Use tools like particle accelerators, telescopes, or lasers to gather data. Example: In high-energy physics, experiments in particle accelerators test the properties of subatomic particles.Definition: Mathematical analysis is essential in physics, used to describe and solve equations that represent physical laws. Approach:Solve equations that describe physical laws, such as those for gravitational force, electromagnetism, or fluid dynamics. Apply calculus, linear algebra, and differential equations to solve complex problems. Example: Calculating the trajectory of a projectile by solving equations of motion.Definition: Computer simulations use algorithms and computational models to simulate complex physical systems and predict outcomes. Approach:Develop computational models to simulate scenarios that may be impractical or impossible to study experimentally. Use software and supercomputers to analyze large datasets and simulate physical systems. Example: Simulating climate models to predict weather patterns or using simulations to study black holes.Definition: The observational method involves collecting data on natural phenomena without experimental intervention, particularly in fields like astrophysics and geophysics. Approach:Use observational tools like telescopes, seismographs, or satellites to collect data on celestial bodies or Earth processes. Example: Observing the movement of celestial objects to study gravitational waves or using telescopes to monitor distant galaxies.Definition: Data analysis is used to interpret the results of experiments or observations and to test the validity of hypotheses statistically. Approach:Analyze data collected from experiments, often using statistical tools to determine the significance of results. Example: Analyzing data from particle collisions in a particle accelerator to discover new subatomic particles. Physics has a profound impact on various fields and practical applications in everyday life: Medicine: Imaging technologies like MRI and X-rays, as well as radiation therapy, are based on principles of physics. Engineering: Mechanical and electrical engineering rely on principles from classical physics, thermodynamics, and electromagnetism. Space Exploration: Principles of astrophysics and relativity are fundamental in the study of space and the development of space travel technologies. Energy: Understanding nuclear and renewable energy sources involves nuclear physics and thermodynamics. Environmental Science: Geophysics and environmental physics help monitor and protect natural resources and understand climate change.Understand the Basics: Start with a strong foundation in classical physics, as it provides the groundwork for more advanced topics. Use Mathematical Skills: Physics relies heavily on math, so be proficient in calculus, algebra, and geometry. Visualize Problems: Draw diagrams to represent physical scenarios; this often makes complex problems easier to understand. Apply Theory to Practice: Use real-life examples or lab experiments to see how physics principles apply in practical scenarios. Utilize Simulations: Computer simulations can help visualize complex phenomena that are difficult to replicate physically. Seek Help and Collaborate: Physics concepts can be challenging; collaborating with peers or consulting instructors can provide different perspectives. Physics is a foundational science that explores the fundamental laws governing the natural world. By investigating matter, energy, and forces, physicists seek to understand the universe, from atomic particles to galaxies. With branches like classical physics, quantum mechanics, and astrophysics, physics encompasses a wide range of topics. Through methods like theoretical modeling, experiments, and simulations, physicists uncover principles that shape modern technology and contribute to solving real-world problems.
Giancoli, D. C. (2013). Physics: Principles with Applications. Pearson Education. Tipler, P. A., & Mosca, G. (2007). Physics for Scientists and Engineers. W. H. Freeman and Company. Halliday, D., Resnick, R., & Walker, J. (2014). Fundamentals of Physics. Wiley. Feynman, R. P. (2011). The Feynman Lectures on Physics. Basic Books. Kittel, C. (2004). Introduction to Solid State Physics. Wiley. Learn how to convert units, with automatic unit canceling. Get practice with prefixes (e.g. kilo, milli, centi) and convert between meters and feet, ounces and grams, and more. Physicists may be roughly divided into two camps: experimental physicists and theoretical physicists. Experimental physicists design and run careful investigations on a broad range of phenomena in nature, often under conditions which are atypical of our everyday lives. They may, for example, investigate what happens to the electrical properties of materials at temperatures very near absolute zero (-460 F; -273 C) or measure the characteristics of energy emitted by very hot gases. Theoretical physicists propose and develop models and theories to explain mathematically the results of experimental observations. Experiment and theory therefore have a broad overlap. Accordingly, experimental physicists remain keenly aware of the current theoretical work in their fields, while theoretical physicists must know the experimenters' results and the context in which the results need be interpreted.It is also useful to distinguish classical physics and modern physics. Classical physics has its origins approximately four hundred years ago in the studies of Galileo and Newton on mechanics, and similarly in the work of Ampere, Faraday, Maxwell and Oersted one hundred fifty years ago in the fields of electricity and magnetism. This physics handles objects which are neither too large nor too small, which move at relatively slow speeds (at least compared to the speed of light: 186,282 miles/second or 299,792 kilometers/second). Various examples of physical phenomenaPhysics is a branch of science. It is one of the most fundamental scientific disciplines. The main goal of physics is to explain how things move in space and time and understand how the universe behaves. It studies matter, forces and their effects.The word physics comes from the Greek word , meaning "nature".[1] Physics can also be defined as "that department of knowledge which relates to the order of nature, or, in other words, to the regular succession of events".[2]Physics is very important in engineering and developing new technologies, such as aviation, electronics and weapons. One reason for starting the mathematical field of calculus was to help develop mechanics, a branch of physics.Modern physics connects ideas about the four laws of symmetry and conservation of energy, momentum, charge, and parity. Astronomy, now a part of physics, is the oldest natural science. In the past it was a part of 'natural philosophy' with other fields of science, such as chemistry and biology. During the scientific revolution, these fields became separate, and physics became a distinct field of knowledge.Main article: History of astronomyAstronomy is one of the oldest natural science. The Sumerians, and Ancient Egyptians studied the stars, mostly with a view to prediction and religion. The first Babylonian star maps date from about 1200 BC. That astronomical events are periodic also dates back to the Babylonians.[3] Their understanding was not scientific, but their observations influenced later astronomy. Much astronomy came from Mesopotamia, Babylonia, Ancient Egypt, and Ancient Greece. Astronomers from Egypt built monuments that showed how objects in the sky moved, and most of the names for the constellations in the Northern hemisphere came from Greek astronomers.Natural philosophy started in Greece around 650 BC when a movement of philosophers replaced superstition with naturalism, which refuted the spiritual. Leucippus and his student Democritus suggested the idea of the atom around this period.Islamic scholars continued to study Aristotelian physics during the Islamic Golden Age. One main contribution was to observational astronomy. Some, like Ibn Sahl,Al-Kindi,Ibn al-Haytham,Al-FarisiandAvicenna, worked on optics and vision. In The Book of Optics, Ibn al-Haytham rejected previous Greek ideas concerning vision and proposed a new theory. He studied how light enters the eye, and developed the camera obscura. European scientists later built eyeglasses, magnifying glasses, telescopes, and cameras from this book.Physics became a separate field of study after the scientific revolution.[4] Galileo's experiments helped to create classical physics. Although he did not invent the telescope, he used it when he looked into the night sky. He supported Copernicus' idea that the Earth moved around the Sun (heliocentrism). He also investigated gravity. Isaac Newton used Galileo's ideas to create his three laws of motion and his law of universal gravitation. Together these laws explained the motion of falling bodies near the earth and the motion of earth and planets around the sun.[5] In a couple centuries, the Industrial Revolution was in full swing and many more discoveries were made in many fields of science. The laws of classical physics are good enough to study objects that move much slower than the speed of light, and are not microscopic. When scientists first studied quantum mechanics, they had to create a new set of laws, which was the start of modern physics.As scientists researched particles, they discovered what classical mechanics could not explain. Classical mechanics predicted that the speed of light varied, but experiments showed the speed of light stayed the same. This was predicted by Albert Einstein's theory of special relativity. Einstein predicted that the speed of electromagnetic radiation through empty space would always be the same. His view of space-time replaced the ancient idea that space and time were quite separate things.Max Planck came up with quantum mechanics to explain why metal releases electrons when you shine a light at it, and why matter emits radiation. Quantum mechanics applies for very small things like the electrons, protons, and neutrons that make up an atom. People like Werner Heisenberg, Erwin Schrdinger, and Paul Dirac continued to work on quantum mechanics and eventually we got the Standard Model.[6][7]Physics is the study of energy and matter in space and time and how they are related to each other. Physicists assume the existence of mass, length, time and electric current and then define (give the meaning of) all other physical quantities in terms of these basic units. Mass, length, time, and electric current are never defined but the standard units used to measure them are always defined. In the International System of Units (abbreviated SI from the French Systme International), the kilogram is the basic unit of mass, the metre is the basic unit of length, the second is the basic unit of time, and the ampere is the basic unit of electric current. In addition to these four units, there are three other ones: the mole, which is the unit of the quantity of matter, the candela which measures the luminous intensity (the power of lighting) and the kelvin, the unit of temperature.Physics studies how things move, and the forces that make them move. For example, velocity and acceleration are used by physics to show how things move. Also, physicists study the forces of gravity, electricity, magnetism and the forces that hold things together.Physics studies very large things, and very small things. For instance, physicists can study stars, planets and galaxies but could also study small pieces of matter, such as atoms and electrons.They may also study sound, light and other waves. As well as that, they could examine energy, heat and radioactivity, and even space and time. Physics not only helps people understand how objects move, but how they change form, how they make noise, how hot or cold they will be, and what they are made of at the smallest level. In short, physics is the branch of science that deals with properties of matter and energy along with the interaction between them.Physics is a quantitative science because it is based on measuring with numbers. Mathematics is used in physics to make models that try to predict what will happen in nature. These predictions are compared to the way the real world works. Physicists are always working to make their models of the world better.Classical mechanics contains major topics such as Newton's laws of motion, Lagrangian mechanics, Hamiltonian mechanics, kinematics, statics, dynamics, chaos theory, acoustics, fluid dynamics, continuum mechanics. Classical mechanics is all about forces acting on a body in nature, balancing forces, maintaining equilibrium state, etc. Electromagnetism is study of charges on a particular body. It contains subtopics such as Electrostatics, electrodynamics, electricity, magnetism, magnetostatics, Maxwell's equations, optics. Thermodynamics and statistical mechanics are related with temperature. It includes main topics such as Heat engine, kinetic theory. It uses terms such as heat(Q), work(W), and internal energy (U). First law of thermodynamics gives us the relation them by the following equation (U = Q W)Quantum mechanics is the study of particle at the atomic level taking into consideration the atomic model. It includes subtopics Path integral formulation, scattering theory, Schrdinger equation, quantum field theory, quantum statistical mechanics.Physics is the science of matter and how matter interacts. Matter is any physical material in the universe. Everything is made of matter. Physics is used to describe the physical universe around us, and to predict how it will behave. Physics is the science concerned with the discovery and characterization of the universal laws which govern matter, movement and forces, and space and time, and other features of the natural world.The sweep of physics is broad, from the smallest components of matter and the forces that hold it together, to galaxies and even larger things. There are only four forces that appear to operate over this whole range. However, even these four forces (gravity, electromagnetism, the weak force associated with radioactivity, and the strong force which holds protons and neutrons in an atom together) are believed to be different parts of a single force.Physics is mainly focused on the goal of making ever simpler, more general, and more accurate rules that define the character and behavior of matter and space itself. One of the major goals of physics is making theories that apply to everything in the universe. In other words, physics can be viewed as the study of those universal laws which define, at the most basic level possible, the behavior of the physical universe.Physics uses the scientific method. That is, data from experiments and observations are collected. Theories which attempt to explain these data are produced. Physics uses these theories to not only describe physical phenomena, but to model physical systems and predict how these physical systems will behave. Physicists then compare these predictions to observations or experimental evidence to show whether the theory is right or wrong.The theories that are well supported by data and are especially simple and general are sometimes called scientific laws. Of course, all theories, including those known as laws, can be replaced by more accurate and more general laws, when a disagreement with data is found.[8]Physics is more quantitative than most other sciences. That is, many of the observations in physics may be represented in the form of numerical measurements. Most of the theories in physics use mathematics to express their principles. Most of the predictions from these theories are numerical. This is because of the areas which physics has addressed work better with quantitative approaches than other areas. Sciences also tend to become more quantitative with time as they become more highly developed, and physics is one of the oldest sciences.Classical physics normally includes the fields of mechanics, optics, electricity, magnetism, acoustics and thermodynamics. Modern physics is a term normally used to cover fields which rely on quantum theory, including quantum mechanics, atomic physics, nuclear physics, particle physics and condensed matter physics, as well as the more modern fields of general and special relativity, but these last two are often considered fields of classical physics as they do not rely on quantum theory. Although this difference can be found in older writings, it is of little new interest as quantum effects are now understood to be of importance even in fields that before were called classical.There are many ways to study physics, and many different kinds of activities in physics. The two main types of activities are the collection of data, and the development of theories.Some subfields of physics can be studied by experiment. For example, Galileo Galilei invented kinematics by making experiments and studying the data. Experimental physics focuses mainly on an empirical approach. Some experiments are done to explore nature, and other experiments are performed to produce data to compare with the predictions of theories.Some other fields in physics like astrophysics and geophysics are mostly observational sciences because most of their data has to be collected passively instead of through experimentation. Galileo, for example, could only look at Jupiter and discover that it has moons. However, observational programs in these fields use many of the same tools and technology that are used in the experimental subfields of physics. Theoretical physics often uses quantitative approaches to develop the theories that attempt to explain the data. In this way, theoretical physicists often use tools from mathematics. Theoretical physics often can involve creating quantitative predictions of physical theories, and comparing these predictions quantitatively with data. Theoretical physics sometimes creates models of physical systems before data is available to test and support these models.These two main activities in physics, data collection, theory production and testing, use many different skills. This has led to a lot of specialization in physics, and the introduction, development and use of tools from other fields. For example, theoretical physicists use mathematics and numerical analysis and statistics and probability and computer software in their work. Experimental physicists develop instruments and techniques for collecting data, using engineering and computer technology and many other fields of technology. Often the tools from these other areas are not quite appropriate for the needs of physics, and need to be changed or more advanced versions have to be made.It is frequent for new physics to be discovered if experimental physicists do an experiment that current theories cannot explain, or for theoretical physicists to generate theories which can then be put to the test by experimental physicists.Experimental physics, engineering and technology are related. Experiments often need specialized tools such as particle accelerators, lasers, and important industrial applications such as transistors and magnetic resonance imaging have come from applied research.Galileo Galilei (15641642)Christiaan Huygens (16291695)Isaac Newton (16431727)Leonhard Euler (17071783)Joseph Louis Lagrange (17361813)Pierre-Simon Laplace (17491827)Joseph Fourier (17681830)Nicolas Lonard Sadi Carnot (17961842)William Rowan Hamilton (18051865)Rudolf Clausius (18221888)James Clerk Maxwell (18311879)J. Willard Gibbs (18391903)Ludwig Boltzmann (18441906)Hendrik A. Lorentz (18531928)Henri Poincar (18541912)Nikola Tesla (18561943)Max Planck (18581947)Albert

Einstein (18791955)Milutin Milankovi (18791958)Emmy Noether (18821935)Max Born (18821970)Niels Bohr (18851962)Erwin Schrdinger (18871961)Louis de Broglie (18921987)Satyendra Nath Bose (18941974)Wolfgang Pauli (19001958)Enrico Fermi (19011954)Werner Heisenberg (19011976)Paul Dirac (19021984)Eugene Wigner (19021995)Robert Oppenheimer (19041967)Sin-Itiro Tomonaga (19061979)Hideki Yukawa (19071981)John Bardeen (19081991)Lev Landau (19081967)Anatoly Vlasov (19081975)Nikolay Bogolyubov (19091992)Subrahmanyan Chandrasekhar (19101995)John Archibald Wheeler (19112008)Richard Feynman (19181988)Julian Schwinger (19181994)Feza Grsey (19211992)Chen Ning Yang (1922)Freeman Dyson (19232020)Gunnar Klln (19261968)Abdus Salam (19261996)Murray Gell-Mann (1929)Riazuddin (1930)Roger Penrose (1931)George Sudarshan (1931)Sheldon Glashow (1932)Tom W. B. Kibble (1932)Steven Weinberg (1933)Gerald Guralnik (1936)Sidney Coleman (19372007)C. R. Hagen (1937)Ratko Janev (1939)Leonard Susskind (1940)Michael Berry (1941)Bertrand Halperin (1941)Stephen Hawking (19422018)Alexander Polyakov (1945)Gerardus 't Hooft (1946)Jacob Bekenstein (1947)Robert Laughlin (1950)American Physical SocietyAstronomyEnergyMatterTime At the start of The Feynman Lectures on Physics, Richard Feynman offers the atomic hypothesis as the single most important scientific concept, that all things are made up of atoms little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another..." Maxwell J.C. 1878. Matter and motion. Van Nostrand, p9. ISBN0-486-66895-9 Aaboe A. 1991. Mesopotamian mathematics, astronomy, and astrology. The Cambridge Ancient History. Volume III (2nd ed). Cambridge University Press. ISBN978-0-521-22717-9 Dijksterhuis E.J. 1986. The mechanization of the world picture: Pythagoras to Newton. Princeton, New Jersey: Princeton University Press. ISBN978-0-691-08403-9 Ben-Chaim M. 2004. Experimental philosophy and the birth of empirical science: Boyle, Locke and Newton. Aldershot: Ashgate. ISBN0-7546-4091-4 Einstein, Albert and Infeld, Leopold 1938. The evolution of physics: from early concept to relativity and quanta. Cambridge University Press. A non-mathematical account. Feynman R.P; Leighton R.B. & Sands M. 1963. The Feynman Lectures on Physics. 1. ISBN0-201-02116-1 An equation (e.g., f = m a) is called a "law" when there are clear empirical results that substantiate it.Wikimedia Commons has media related to Physics.Units and Measurements Question Retrieved from " is a good physics question. What is physics question and answer. What is a quantum physics question. What is a hard physics question.