Reddit and its partners use cookies and similar technologies to provide you with a better experience. By accepting all cookies, you agree to our use of cookies to deliver and maintain our services and site, improve the quality of Reddit, personalize Reddit content and advertising, and measure the effectiveness of advertising. By rejecting non-essential cookies, Reddit may still use certain cookies to ensure the proper functionality of our platform. For more information, please see our Cookie Notice and our Privacy Policy. You need to enable JavaScript to access Isaac Physics. In the pursuit of academic excellence, students often find themselves grappling with the intricacies of physics. This intricate subject demands a deep understanding of concepts and a proficiency in problem-solving. Fortunately, a revolutionary online platform, Isaac Physics, has emerged as a beacon of hope for students and educators alike. Developed by the esteemed University of Cambridge, this free resource offers a wealth of tools and resources to aid in mastering the art of physics problem-solving. Unlocking the Power of Isaac Physics Isaac Physics is a comprehensive platform designed to cater to the needs of students from Year 7 through to university level. Its primary objective is to foster a strong foundation in physics problem-solving, enabling students to tackle even the most challenging concepts with confidence. Whether you're a teacher seeking engaging classroom materials or a student striving for academic excellence, Isaac Physics has something to offer. A Multifaceted Approach to Learning One of the standout features of Isaac Physics is its multifaceted approach to learning. The platform offers a diverse range of resources, catering to different learning styles and preferences. From interactive concept lessons and revision overviews to virtual masterclasses and problem-solving guides, students can immerse themselves in a dynamic and engaging learning environment. Concept Lessons: Building Blocks of Understanding The concept lessons on Isaac Physics are meticulously crafted to introduce and reinforce core physics ideas. Each lesson comprises a series of videos, practice questions, and a comprehensive tutorial, ensuring that students grasp the fundamentals before progressing to more advanced topics. These lessons are designed to be flexible, allowing teachers to incorporate them into classroom activities, remote teaching sessions, or self-paced learning. Revision Overviews: Consolidating Knowledge For students seeking a more comprehensive review, Isaac Physics offers topic revision overview lessons. These lessons encompass an entire topic, such as electricity, mechanics, or waves, providing a holistic perspective on the subject matter. Periodic questions are woven into the lessons, ensuring active engagement and reinforcement of key concepts. Virtual Masterclasses: Elevating Problem-Solving Skills Isaac Physics goes beyond traditional learning methods by offering virtual masterclasses. These interactive sessions are facilitated by experienced university lecturers, school teachers, and tutors, all of whom have undergone rigorous background checks. During these masterclasses, students are presented with challenging problems that push the boundaries of their problem-solving abilities, preparing them for the rigors of higher education and future careers in STEM fields. Tailored Resources for Every Level Whether you're a GCSE student, an A-Level candidate, or a university aspirant, Isaac Physics caters to your specific needs. The platform offers a wealth of resources tailored to various examination boards, including AQA, CIE, Edexcel, Eduqas, IB, OCR, and WJEC, ensuring that you have access to relevant and up-to-date materials. GCSE Resources: Laying the Foundation For GCSE students, Isaac Physics provides a comprehensive suite of resources aligned with the Mastering Essential GCSE Physics book. These resources include individual concept lessons, revision overviews, and virtual masterclasses designed to reinforce key topics such as mechanics, electricity, energy, waves and optics, nuclear physics, and gases. A-Level Resources: Preparing for University As students progress to A-Level studies, Isaac Physics offers a wealth of resources to support their journey. From individual concept lessons spanning mechanics, electric circuits, waves, uncertainties, fields, capacitors, and nuclear physics, to revision overviews covering broader topics like electricity, mechanics, quantum physics, waves and optics, and thermal physics, the platform equips students with the tools they need to excel. Personalized Learning Experience One of the standout features of Isaac Physics is its commitment to personalized learning. By creating a free account, students can track their progress, monitor their performance, and even share their achievements with their teachers. This level of transparency and accountability fosters a collaborative learning environment, enabling educators to provide targeted support and guidance. Continuous Support and Expansion The team behind Isaac Physics is dedicated to continuously enhancing the platform's offerings. Regular updates introduce new features, resources, and improvements based on user feedback and evolving educational needs. This commitment to ongoing development ensures that students and teachers alike have access to the most up-to-date and effective tools for mastering physics. Fostering a Love for Physics Beyond its practical applications, Isaac Physics aims to cultivate a genuine passion for physics among its users. Through engaging content, interactive activities, and a supportive community, the platform seeks to inspire curiosity, encourage critical thinking, and instill a lifelong appreciation for the wonders of the physical world. Conclusion In the ever-evolving landscape of education, Isaac Physics stands as a beacon of innovation and excellence. By providing a comprehensive suite of resources, personalized learning experiences, and a supportive community, this platform empowers students and educators alike to conquer the challenges of physics. Whether you're a student seeking academic success or a teacher striving to inspire the next generation of scientists, Isaac Physics is a invaluable companion on your journey to mastering the art of physics problem-solving. We use cookies on this site to enhance your user experienceBy clicking any link on this page you are giving your consent for us to set cookies. More info By clicking any link on this page you are giving your consent for us to set cookies. More info Strictly Necessary Cookies Strictly Necessary Cookie should be enabled at all times so that we can save your preferences for cookie settings. If you disable this cookie, we will not be able to save your preferences. This means that every time you visit this website you will need to enable or disable cookies again. You need to enable JavaScript to access Isaac Physics. Sir Isaac Newton contributed significantly to the field of science over his lifetime. He invented calculus and provided a clear understanding of optics. But his most significant work had to do with forces, and specifically with the development of a universal law of gravitation and his laws of motion. Isaac Newton was born on Christmas Day to a poor farming family in Woolsthorpe, England, in 1642. At the time of Newton's birth England used the Julian calendar, however, when England adopted the Gregorian calendar in 1752, his birthday became 4th January 1643. Isaac Newton arrived in the world only a few months after his father, Isaac Newton Sr, had died. "The boy expected to live managing the farm in the place of the father he had never known," wrote James Gleick in "Isaac Newton" (Vintage, 2004). You may like However, when it became clear a farming life was not for him, Newton attended Trinity College in Cambridge, England. "He did not know what he wanted to be or do, but it was not tend sheep or follow the plough and the dung cart," wrote Gleick. While there, he took an interest in mathematics, optics, physics, and astronomy. After his graduation, he began to teach at the college and was appointed as the second Lucasian Chair there. Today, the chair is considered the most renowned academic chair in the world, held by the likes of Charles Babbage and Stephen Hawking.In 1689, Newton was elected as a member of parliament for the university. In 1703, he was elected as president of the Royal Society, a fellowship of scientists that still exists today. He was knighted by Queen Anne in 1705. He never married.What are Isaac Newton's laws of motion? Newton's most famous work came with the publication of his "Philosophiae Naturalis Principia Mathematica" ("Mathematical Principles of Natural Philosophy"), generally called Principia. In it, he determined the three laws of motion for the universe.Newton's first law describes how objects move at the same velocity unless an outside force acts upon them. (A force is something that causes or changes motion.) Thus, an object sitting on a table remains on the table until a force — the push of a hand, or gravity — acts upon it. Similarly, an object travels at the same speed unless it interacts with another force, such as friction.His second law of motion provided a calculation for how forces interact. The law states that a force is equal to the change in the momentum (mass multiplied by velocity) per change in time. Therefore, when more force is applied to an object, its acceleration also increases, but when the mass of the object increases and the force remains constant, its acceleration decreases.Newton's third law states that for every action in nature, there is an equal and opposite reaction. If one body applies a force on a second, then the second body exerts a force of the same strength on the first, in the opposite direction. From all of this, Newton calculated the universal law of gravitation. He found that as two bodies move farther away from one another, the gravitational attraction between them decreases by the inverse of the square of the distance. Thus, if the objects are twice as far apart, the gravitational force is only a fourth as strong; if they are three times as far apart, it is only a ninth of its previous power.These laws helped scientists understand more about the motions of planets in the solar system, and of the moon around Earth.Related: What makes Newton's laws work? Here's the simple trick.Isaac Newton's apple The story of Isaac Newton and the apple tree may well be a self-created myth, but it might have helped his audience understand some of the concepts he was explaining. (Image credit: Photos.com via Getty Images)A popular myth tells of an apple falling from a tree in Newton's garden, which brought Newton to an understanding of forces, particularly gravity. Whether the incident actually happened is unknown, but historians doubt the event — if it occurred — was the driving force in Newton's thought process.The myth tells of Isaac Newton having returned to his family farm in Woolsthorpe, escaping Cambridge for a short time as it was dealing with a plague outbreak. As he sat in the farm's orchard, an apple fell from one of the trees (in some tellings it hit Newton on the head). Watching this happen, Newton began to consider the forces that meant the apple always fell directly towards the ground, beginning his examination of gravity.One of the reasons that this story gained a foothold in popular understanding is that it is an anecdote Newton himself seems to have shared. "Toward the end of his life, Newton told the apple anecdote around four times, although it only became well known in the nineteenth century," wrote Patricia Fara, a historian of science at the University of Cambridge, in a chapter of "Newton's Apple and Other Myths about Science" (Harvard University Press, 2020).However, it would be at least 20 years before Newton published his theories on gravity. It seems more likely that Newton used the story as a means of connecting the concept of gravity's impact on objects on Earth with its impact on objects in space for his contemporary audience.The apple tree in question — known as the "Flower of Kent" — still blooms in the orchard of Woolsthorpe Manor, and is now a popular tourist attraction. Isaac Newton's inventions and discoveries Newton worked on a number of different theories and proofs, here depicted working on refracting light through a prism. (Image credit: Apic / Contributor via Getty Images)While a student, Newton was forced to take a two-year hiatus when plague closed Trinity College. At home, he continued to work with optics, using a prism to separate white light, and became the first person to argue that white light was a mixture of many types of rays, rather than a single entity. He continued working with light and color over the next few years and published his findings in "Opticks" in 1704.Disturbed by the problems with telescopes at the time, he invented the reflecting telescope, grinding the mirror and building the tube himself. Relying on a mirror rather than lenses, the telescope presented a sharper image than refracting telescopes at the time. Modern techniques have reduced the problems caused by lenses, but large telescopes such as the James Webb Space Telescope use mirrors. As a student, Newton studied the most advanced mathematical texts of his time. While on hiatus, he continued to study mathematics, laying the ground for differential and integral calculus. He united many techniques that had previously been considered separately, such as finding areas, tangents, and the lengths of curves. He wrote De Methodis Serierum et Fluxionum in 1671 but was unable to find a publisher.Newton also established a cohesive scientific method, to be used across disciplines. Previous explorations of science varied depending on the field. Newton established a set format for experimentation still used today.However, not all of Newton's ideas were quite as revolutionary. In Principia, Newton describes how rarefied vapor from comet tails is pulled into Earth's gravitational grasp and enables the movements of the planet's fluids along with the "most subtle and useful part of our air, and so much required to sustain the life of all things with us." Isaac Newton quotes"Amicus Plato amicus Aristoteles magis amica verita."(Plato is my friend, Aristotle is my friend, but my greatest friend is truth.)—Written in the margin of a notebook while a student at Cambridge. In Richard S. Westfall, Never at Rest (1980), 89."Genius is patience."—The Homiletic Review, Vol. 83-84 (1922), Vol. 84, 290."If I have seen further it is by standing on the shoulders of giants."—Letter to Robert Hooke (5 Feb 1675-6).In H. W. Turnbull (ed.), The Correspondence of Isaac Newton, 1, 1661-1675 (1959), Vol. 1, 416."I see I have made my self a slave to Philosophy."—Letter to Henry Oldenburg (18 Nov 1676). In H. W. Turnbull (ed.), The Correspondence of Isaac Newton, 1676-1687 (1960), Vol. 2, 182."I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."—First reported in Joseph Spence, Anecdotes, Observations and Characters, of Books and Men (1820), Vol. 1 of 1966 edn, sect. 1259, p. 462"To any action there is always an opposite and equal reaction; in other words, the actions of two bodies upon each other are always equal and always opposite in direction."—The Principia: Mathematical Principles of Natural Philosophy (1687)"Truth is ever to be found in simplicity, and not in the multiplicity and confusion of things."—'Fragments from a Treatise on Revelation". In Frank E. Manuel, The Religion of Isaac Newton (1974), 120.How did Sir Isaac Newton die?Newton died in 1727 during his sleep at the age of 84. Although the cause of death is unknown, a 1979 study published by Newton's own Royal Society suggests mercury poisoning may have contributed to the decline of his physical and mental health. During the exhumation of his body, large amounts of mercury were found in the scientist's system, likely due to his work with alchemy. Newton conducted several experiments to convert base metals, such as mercury and copper into precious metals, such as gold and silver. "In 1693 Newton suffered from insomnia and poor digestion; and he also wrote irrational letters to friends. Although most scholars have attributed Newton's breakdown to psychological factors, it is possible that mercury poisoning may have been the principal cause," wrote L. W. Johnson and M. L. Wolbarsht "Mercury Poisoning: A probable cause of Isaac Newton's physical and mental ills: Notes and Records of the Royal Society of London Vol. 34. No. 1." .After his death, his body was moved to a more prominent place in Westminster Abbey. His white and grey marble monument stands in the nave of the Abbey's choir screen and boasts sculptures of Newton lounging surrounded by children using the many instruments, such as telescopes, associated with Newton's work. The inscription on the monument — originally written in Latin — reads: "Here is buried Isaac Newton, Knight, who by a strength of mind almost divine, and mathematical principles peculiarly his own, explored the course and figures of the planets, the paths of comets, the tides of the sea, the dissimilarities in rays of light, and, what no other scholar has previously imagined, the properties of the colours thus produced. Diligent, sagacious and faithful, in his expositions of nature, antiquity and the holy Scriptures, he vindicated by his philosophy the majesty of God mighty and good, and expressed the simplicity of the Gospel in his manners. Mortals rejoice that there has existed such and so great an ornament of the human race! He was born on 25th December 1642, and died on 20th March 1726." The date of his death on his monument is given in the Julian calendar. Additional resourcesIf you want to learn more about the impact of this celebrated scientist, then you should read about how Isaac Newton Changed the World. If you're wondering whether Newton's second law of motion works in space then an Astronaut has tested the theory out.Bibliography"Isaac Newton" by James Gleick (Vintage, 2004)"Mercury Poisoning: A probable cause of Isaac Newton's physical and mental ills: Notes and Records of the Royal Society of London Vol. 34. No. 1." by L. W. Johnson and M. L. Wolbarsht (July 1979)"The Mathematical Principles of Natural Philosophy" by Isaac Newton (Flame Tree Collections, 2020)"Newton's Apple and Other Myths about Science" edited by Ronald L. Numbers and Kostas Kampourakis (Harvard University Press, 2020)"Life After Gravity: Isaac Newton's London Career" by Patricia Fara (Oxford University Press, 2021)"Isaac Newton" Stanford Encyclopedia of Philosophy (2007)"Isaac Newton" University of St Andrews (2000)"Sir Isaac Newton" Westminster Abbey (2023) A1 Using And Rearranging EquationsA1 Worked SolutionsA2 Derived and Base SI Units A3 Standard Form and Prefixes A4 Converting Units A5 Gradients and Intercepts of Graphs A6 Equations Of Graphs A7 Area Under the Line on a Graph A8 Area Under the Line on a Graph II A9 Factor and Percentage Changes A10 Proportionality Section B: Mechanics B1 Components of a Vector B2 Adding Vectors B3 Uniform Accelerated Motion in One Dimension B4 Trajectories B5 Moments B6 Stress Strain and Young's Modulus B7 Springs B8 Work Energy and Power B9 Energy, Springs and Materials Section C: Electric Circuits C1 Combinations of Resistors C2 Charge Carriers C3 Charge Carriers II C4 Kirchhoff's Laws C4a Additional Kirshhoff's Laws C5 Potential Dividers C6 Internal Resistance C6a Additional Internal Resistance Section D: Waves D1 Amplitude and Intensity D3 Path Difference D4 Interference D5 Standing Waves D6 The Photoelectric Effect D8 Refraction and Total Internal Reflection Section E: Uncertainties E1 Absolute Uncertainties E2 Relative Uncertainties E3 Propagating Uncertainties E4 Accuracy, Percentage Difference and Reliability Section F: Mechanics F1 Force and Momentum F2 Conservation of Momentum F3 Units of Rotary Motion F4 Centripetal Acceleration F5 Newtonian Gravity F7 Oscillators Section G: Gas Laws G1 Kelvin Scale of Temperature G2 Gas Laws G3 Heat Capacity G4 Latent Heat and Heat Capacity Section H: Fields H1 Uniform Electric Fields H2 Electric Field Near Point Charges H3 Speed of Electron in an Electric Field H4 Force on a Conductor in a Magnetic Field H5 Force on a Particle in a Magnetic Field H6 Circular Paths of Particles in Magnetic Fields H7 Magnetic Flux and Faraday's Law H8 Transformers H9 Energies and Potentials of Charges in Electric Fields Section I: Capacitors I1 Charge and Energy Stored on a Capacitor I2 Capacitor Networks I3_Discharge_of_a_Capacitor Section J: Nuclear Physics J2 Activity and Decay J3 Nuclear Decay with Time J4 Energy in Nuclear Reactions Section L: Fact Sheets L1 Mass Spectrometers L2 Fundamental Particles and Interactions L3 Nuclear Reactors L4 X-Rays L5 Ultrasound L7 Stars Other A-level Boards (not directly taken from the book) Wave Motion The Wave Equation Electromagnetic Spectrum Polarisaton Linking Concepts Book 25. Energy and Fields - closest approach 33. Capacitors and Resistors Exponential Decay - Using Logarithms Select Difficult Questions A Chain on a Peg Mastering Essential GCSE Physics Book Board 16 Board 30 Board 31 Board 42 Board 48 Board 53 Introduction to Isaac Physics As an experienced physics enthusiast, I've found that Isaac Physics has been an invaluable resource in my journey to deepen my understanding of the subject. This online platform, developed by the University of Cambridge, offers a wealth of interactive lessons, practice problems, and tools designed to help students and lifelong learners alike master the principles of physics. In this comprehensive guide, I'll share my insights and strategies for making the most of Isaac Physics and taking your physics knowledge to new heights. Whether you're a student preparing for exams or a curious individual looking to expand your scientific horizons, this article will equip you with the necessary skills and resources to conquer the challenges of Isaac Physics. The Importance of Mastering Isaac Physics Physics, at its core, is a fundamental science that underpins our understanding of the natural world. From the smallest subatomic particles to the grandest celestial bodies, the principles of physics govern the intricate workings of the universe. Mastering Isaac Physics is crucial for several reasons: Deeper Understanding of Concepts: Isaac Physics goes beyond rote memorization, encouraging users to truly comprehend the underlying concepts and principles of physics. By engaging with interactive simulations, problem-solving exercises, and explanatory materials, you'll develop a robust, intuitive grasp of the subject matter. Improved Problem-Solving Skills: One of the hallmarks of Isaac Physics is its focus on problem-solving. By tackling a wide range of practice problems, you'll hone your analytical skills, learn to break down complex issues, and develop a systematic approach to finding solutions. Preparation for Academic and Professional Pursuits: Whether you're a student preparing for exams or an individual seeking to advance in physics-related fields, mastering Isaac Physics can be a valuable asset. The skills and knowledge gained through this platform can enhance your performance in academic settings and open doors to exciting career opportunities. How to Navigate the Isaac Physics Website The Isaac Physics website (is user-friendly and intuitive, making it easy to navigate and explore its vast resources. Here's a quick overview of the key sections and features: Lessons: This section offers a comprehensive collection of interactive lessons covering a wide range of physics topics, from mechanics and electromagnetism to quantum physics and astrophysics. Each lesson includes explanations, animations, and practice problems to reinforce your understanding. Practice: The "Practice" section is where you can delve into a vast library of physics problems, ranging from beginner to advanced levels. You can filter problems by topic, difficulty, and even exam-specific requirements, allowing you to tailor your practice sessions to your needs. Exams: This section provides exam-specific resources, including past papers, mark schemes, and revision materials. Whether you're preparing for school-level exams, university admissions tests, or professional certifications, you'll find valuable tools to help you succeed. Discussion Forums: The Isaac Physics community is highly active, and the discussion forums are a treasure trove of knowledge. Here, you can engage with other users, ask questions, share insights, and learn from the collective experience of the community. Personal Dashboard: The website offers a personal dashboard where you can track your progress, view your problem-solving history, and access personalized recommendations based on your performance and learning goals. Understanding the Different Levels of Difficulty in Isaac Physics One of the key features of Isaac Physics is its ability to cater to learners of all skill levels. The platform offers a range of problem sets and resources that are categorized by difficulty, allowing you to gradually build your skills and confidence: Beginner Level: These problems are designed to introduce fundamental concepts and help you develop a solid foundation in physics. They often focus on straightforward applications of basic principles and equations. Intermediate Level: As you progress, the problems become more complex, requiring a deeper understanding of physics concepts and the ability to apply them in more sophisticated scenarios. Advanced Level: The advanced-level problems challenge you to tackle complex, multi-step problems that may involve the integration of multiple physics principles or the application of advanced mathematical techniques. Exam-Specific Levels: In addition to the general difficulty levels, Isaac Physics also offers problem sets tailored to specific exams, such as A-Level, IB, and university admissions tests. These resources can be particularly valuable for students preparing for high-stakes assessments. By starting at the appropriate level and systematically working your way through the different difficulty tiers, you'll be able to build a robust understanding of physics and develop the problem-solving skills necessary to excel in your academic or professional pursuits. Tips and Strategies for Solving Isaac Physics Problems Solving physics problems can be a daunting task, but with the right strategies and techniques, you can tackle even the most challenging problems with confidence. Here are some tips to help you navigate the world of Isaac Physics: Understand the Fundamentals: Before diving into problem-solving, ensure that you have a solid grasp of the underlying physics concepts and principles. Review the relevant lessons and explanations to solidify your foundational knowledge. Identify the Relevant Principles: Carefully read the problem statement and identify the key physics principles and equations that are applicable to the given scenario. This will help you develop a structured approach to solving the problem. Visualize the Problem: Whenever possible, try to visualize the problem using diagrams, sketches, or mental models. This can aid in your understanding of the physical system and the relationships between the variables involved. Break Down Complex Problems: If a problem seems overwhelming, break it down into smaller, more manageable steps. Tackle each step methodically, ensuring that you understand the logic behind each intermediate solution. Check Your Work: Once you've arrived at a solution, don't forget to double-check your work. Verify your calculations, ensure that the units are correct, and consider whether your answer makes sense within the context of the problem. Learn from Mistakes: If you encounter difficulties or make mistakes, don't be discouraged. Analyze where you went wrong, and use that knowledge to improve your problem-solving skills for the future. Utilize the Discussion Forums: The Isaac Physics community is a valuable resource, and the discussion forums can be a great place to seek guidance, share insights, and learn from the experiences of other users. By incorporating these strategies into your Isaac Physics practice, you'll develop a systematic approach to problem-solving and increase your chances of success. Common Mistakes to Avoid while Using Isaac Physics While Isaac Physics is an excellent resource for learning and practicing physics, there are a few common pitfalls that users should be aware of and try to avoid: Rushing Through Problems: It can be tempting to quickly move from one problem to the next, but this approach often leads to a superficial understanding. Take the time to thoroughly understand each problem and the underlying concepts before moving on. Neglecting Dimensional Analysis: Paying attention to the units and dimensions of the variables in a problem is crucial for ensuring the validity of your solutions. Don't overlook this important step in your problem-solving process. Failing to Review Feedback: When you submit a solution on Isaac Physics, the platform provides detailed feedback and explanations. Make sure to review this feedback carefully, as it can help you identify and address any misconceptions or errors in your approach. Ignoring the Discussion Forums: The discussion forums on Isaac Physics are a valuable resource, but they are often underutilized. Don't hesitate to ask questions, share your insights, or engage with the community to deepen your understanding. Relying Too Heavily on Answers: While the availability of answers on Isaac Physics can be helpful, it's important not to become overly dependent on them. Try to solve problems independently first, and only refer to the answers as a last resort or for verification purposes. By being mindful of these common pitfalls and making a conscious effort to avoid them, you'll be well on your way to mastering Isaac Physics and achieving your physics learning goals. Utilizing the Discussion Forums on Isaac Physics The discussion forums on the Isaac Physics website are a true gem for anyone looking to deepen their understanding of the subject. These forums are a vibrant hub of activity, where users from all backgrounds and skill levels come together to share their knowledge, ask questions, and engage in thought-provoking discussions. One of the key advantages of the Isaac Physics discussion forums is the diversity of perspectives and experiences that you'll encounter. Whether you're a seasoned physics enthusiast or a beginner just starting your journey, you'll find that the community is welcoming and eager to help. By engaging with other users, you'll not only gain valuable insights but also develop a stronger sense of camaraderie and shared purpose. In addition to asking questions and seeking guidance, the discussion forums can also be a powerful tool for reinforcing your own understanding. By explaining concepts to others or offering your own solutions and insights, you'll solidify your grasp of the material and gain a deeper appreciation for the nuances of physics. To make the most of the Isaac Physics discussion forums, consider the following tips: Be an Active Participant: Don't hesitate to post your own questions, share your thought processes, or offer solutions to the problems posed by others. The more you engage, the more you'll learn. Carefully Read and Respond to Feedback: When you receive responses to your posts, read them thoroughly and consider the perspectives and suggestions offered by other users. This can help you identify areas for improvement and gain new insights. Contribute to Existing Discussions: Scan the forums for topics that interest you, and don't be afraid to chime in with your own thoughts and ideas. Your contributions can help advance the conversation and benefit the entire community. Explore Diverse Topics: While the primary focus of the Isaac Physics discussion forums is on the core subject matter, you'll also find engaging conversations on related topics, such as the history of physics, career paths, and the latest scientific developments. By actively participating in the Isaac Physics discussion forums, you'll not only enhance your own understanding of the subject but also contribute to the growth and success of the broader physics community. Accessing and Interpreting Isaac Physics Answers One of the key features of Isaac Physics is the availability of detailed answers and solutions to the practice problems. These answers can be an invaluable resource, particularly when you're stuck or need to verify your work. To access the answers on the Isaac Physics platform, simply navigate to the "Practice" section, select the problem you've worked on, and click the "View Solution" button. The platform will then provide you with a step-by-step walkthrough of the solution, including the necessary calculations, explanations, and diagrams. When reviewing the answers, it's important to approach them with a critical eye. Don't simply memorize the solutions; instead, take the time to understand the underlying logic and the application of the relevant physics principles. This will not only help you solidify your understanding but also prepare you for tackling similar problems in the future. Here are some tips for effectively interpreting and learning from the Isaac Physics answers: Identify the Key Concepts: As you review the solution, pay close attention to the physics concepts and principles that are being applied. Ensure that you have a firm grasp of these fundamental ideas. Analyze the Problem-Solving Approach: Examine the step-by-step process used to arrive at the solution. Understand the reasoning behind each step and how the various variables and equations are manipulated. Verify Your Own Work: Compare your initial solution to the one provided. Identify any differences in your approach and use the feedback to improve your problem-solving skills. Explore Alternative Strategies: In some cases, there may be multiple valid approaches to solving a problem. Consider how you might have tackled the problem differently and whether those alternative strategies would have led to the same result. Reflect on Your Learning: After reviewing the answer, take a moment to reflect on what you've learned and how it can be applied to future problems. This will help cement your understanding and prepare you for more advanced challenges. By actively engaging with the Isaac Physics answers and using them as a learning tool, you'll not only improve your problem-solving abilities but also develop a deeper, more nuanced understanding of the underlying physics concepts. Additional Resources for Mastering Isaac Physics While Isaac Physics is a comprehensive platform that offers a wealth of resources, there are also numerous external resources that can complement your learning journey and help you master the subject even further. Here are a few additional resources to consider: Textbooks and Reference Books: Supplementing your Isaac Physics practice with trusted physics textbooks and reference materials can provide you with a more in-depth understanding of the subject matter. Online Tutorials and Video Lectures: Platforms like YouTube, Coursera, and edX offer a wide range of high-quality physics tutorials and video lectures that can reinforce the concepts covered in Isaac Physics. Physics Blogs and Websites: Exploring physics-focused blogs and websites can expose you to diverse perspectives, cutting-edge research, and thought-provoking discussions that can deepen your understanding of the field. Physics Podcasts: Listening to physics-related podcasts can be a great way to stay up-to-date with the latest developments in the field and gain insights from leading experts. Physics Competitions and Challenges: Participating in physics competitions, such as the Physics Olympiad or the International Young Physicists' Tournament, can challenge you to apply your skills in a competitive setting and push the boundaries of your knowledge. Study Groups and Peer Collaboration: Forming or joining a study group with fellow Isaac Physics users can foster a collaborative learning environment and provide opportunities for peer-to-peer support and knowledge sharing. By leveraging these additional resources, you'll be able to create a well-rounded learning experience that complements your work on the Isaac Physics platform and takes your physics mastery to new heights. Conclusion: Take Your Physics Understanding to the Next Level with Isaac Physics In conclusion, Isaac Physics is a powerful and comprehensive platform that can transform your understanding of physics and propel you towards academic and professional success. By mastering the various features and resources offered by Isaac Physics, you'll develop a robust foundation in physics concepts, hone your problem-solving skills, and position yourself for excellence in your chosen field. If you're ready to take your physics understanding to the next level, I encourage you to dive into the wealth of resources available on the Isaac Physics website. Sign up for an account, explore the interactive lessons, tackle the practice problems, and engage with the vibrant community of physics enthusiasts. With dedication and a strategic approach, you'll be well on your way to becoming a physics master. You need to enable JavaScript to access Isaac Physics. Scientific field of study For other uses, see Physics (disambiguation). Not to be confused with Physis. The expansion of the universe according to the Big Bang theory in physics Part of a series onPhysics Index Outline Glossary History (timeline) Branches Acoustics Astrophysics Atomic physics Biophysics Classical physics Electromagnetism Geophysics Mechanics Modern physics Nuclear physics Optics Thermodynamics Research Physicist (list) List of physics awards List of journals List of unsolved problems Physics portal Categoryvte Physics is the scientific study of matter, its fundamental constituents, its motion and behavior through space and time, and the related entities of energy and force.[1] It is one of the most fundamental scientific disciplines.[2][3][4] A scientist who specializes in the field of physics is called a physicist. Physics is one of the oldest academic disciplines.[5] Over much of the past two millennia, physics, chemistry, biology, and certain branches of mathematics were a part of natural philosophy, but during the Scientific Revolution in the 17th century, these natural sciences branched into separate research endeavors. Physics intersects with many interdisciplinary areas of research, such as biophysics and quantum chemistry, and the boundaries of physics are not rigidly defined. New ideas in physics often explain the fundamental mechanisms studied by other sciences[2] and suggest new avenues of research in these and other academic disciplines such as mathematics and philosophy. Advances in physics often enable new technologies. For example, advances in the understanding of electromagnetism, solid-state physics, and nuclear physics led directly to the development of technologies that have transformed modern society, such as television, computers, domestic appliances, and nuclear weapons;[2] advances in thermodynamics led to the development of industrialization; and advances in mechanics inspired the development of calculus. Main article: History of physics The word physics comes from the Latin physica ('study of nature'), which itself is a borrowing of the Greek φυσική (phusikḗ 'natural science'), a term derived from φύσις (phúsis 'origin, nature, property').[6][7][8] Main article: History of astronomy Ancient Egyptian astronomy is evident in monuments like the ceiling of Senemut's tomb from the Eighteenth Dynasty of Egypt. Astronomy is one of the oldest natural sciences. Early civilizations dating before 3000 BCE, such as the Sumerians, ancient Egyptians, and the Indus Valley Civilisation, had a predictive knowledge and a basic awareness of the motions of the Sun, Moon, and stars. The stars and planets, believed to represent gods, were often worshipped. While the explanations for the observed positions of the stars were often unscientific and lacking in evidence, these early observations laid the foundation for later astronomy, as the stars were found to traverse great circles across the sky,[5] which could not explain the positions of the planets. According to Asger Aaboe, the origins of Western astronomy can be found in Mesopotamia, and all Western efforts in the exact sciences are descended from late Babylonian astronomy.[9] Egyptian astronomers left monuments showing knowledge of the constellations and the motions of the celestial bodies,[10] while Greek poet Homer wrote of various celestial objects in his Iliad and Odyssey; later Greek astronomers provided names, which are still used today, for most constellations visible from the Northern Hemisphere.[11] Main article: Natural philosophy Natural philosophy has its origins in Greece during the Archaic period (650 BCE – 480 BCE), when pre-Socratic philosophers like Thales rejected non-naturalistic explanations for natural phenomena and proclaimed that every event had a natural cause.[12] They proposed ideas verified by reason and observation, and many of their hypotheses proved successful in experiment;[13] for example, atomism was found to be correct approximately 2000 years after it was proposed by Leucippus and his pupil Democritus.[14] Aristotle(384–322 BCE) During the classical period in Greece (6th, 5th and 4th centuries BCE) and in Hellenistic times, natural philosophy developed along many lines of inquiry. Aristotle (Greek: Ἀριστοτέλης, Aristotélēs) (384–322 BCE), a student of Plato, wrote on many subjects, including a substantial treatise on "Physics" – in the 4th century BC. Aristotelian physics was influential for about two millennia. His approach mixed some limited observation with logical deductive arguments, but did not rely on experimental verification of deduced statements. Aristotle's foundational work in Physics, though very imperfect, formed a framework against which later thinkers further developed the field. His approach is entirely superseded today. He explained ideas such as motion (and gravity) with the theory of four elements. Aristotle believed that each of the four classical elements (air, fire, water, earth) had its own natural place.[15] Because of their differing densities, each element will revert to its own specific place in the atmosphere.[16] So, because of their weights, fire would be at the top, air underneath fire, then water, then lastly earth. He also stated that when a small amount of one element enters the natural place of another, the less abundant element will automatically go towards its own natural place. For example, if there is a fire on the ground, the flames go up into the air in an attempt to go back into its natural place where it belongs. His laws of motion included: that heavier objects will fall faster, the speed being proportional to the weight and the speed of the object that is falling depends inversely on the density object it is falling through (e.g. density of air).[17] He also stated that, when it comes to violent motion (motion of an object when a force is applied to it by a second object) that the speed that object moves, will only be as fast or strong as the measure of force applied to it.[17] The problem of motion and its causes was studied carefully, leading to the philosophical notion of a "prime mover" as the ultimate source of all motion in the world (Book 8 of his treatise Physics). Main articles: European science in the Middle Ages and Physics in the medieval Islamic world Ibn al-Haytham (c. 965 – c. 1040) wrote of his camera obscura experiments in the Book of Optics.[18] The Western Roman Empire fell to invaders and internal decay in the fifth century, resulting in a decline in intellectual pursuits in western Europe. By contrast, the Eastern Roman Empire (usually known as the Byzantine Empire) resisted the attacks from invaders and continued to advance various fields of learning, including physics.[19] In the sixth century, John Philoponus challenged the dominant Aristotelian approach to science although much of his work was focused on Christian theology.[20] In the sixth century, Isidore of Miletus created an important compilation of Archimedes' works that are copied in the Archimedes Palimpsest. Islamic scholarship inherited Aristotelian physics from the Greeks and during the Islamic Golden Age developed it further, especially placing emphasis on observation and a priori reasoning, developing early forms of the scientific method. The most notable innovations under Islamic scholarship were in the field of optics and vision,[21] which came from the works of many scientists like Ibn Sahl, Al-Kindi, Ibn al-Haytham, Al-Farisi and Avicenna. The most notable work was The Book of Optics (also known as Kitāb al-Manāẓir), written by Ibn al-Haytham, in which he presented the alternative to the ancient Greek idea about vision.[22] His discussed his experiments with camera obscura, showing that light moved in a straight line; he encouraged readers to reproduce his experiments making him one of the originators of the scientific method[23][24] The basic way camera obscura works Further information: History_of_physics § Scientific_Revolution Physics became a separate science when early modern Europeans used experimental and quantitative methods to discover what are now considered to be the laws of physics.[25][page needed] Major developments in this period include the replacement of the geocentric model of the Solar System with the heliocentric Copernican model, the laws governing the motion of planetary bodies (determined by Johannes Kepler between 1609 and 1619), Galileo's pioneering work on telescopes and observational astronomy in the 16th and 17th centuries, and Isaac Newton's discovery and unification of the laws of motion and universal gravitation (that would come to bear his name).[26] Newton, and separately Gottfried Wilhelm Leibniz, developed calculus,[27] the mathematical study of continuous change, and Newton applied it to solve physical problems.[28] Galileo Galilei (1564–1642) related mathematics, theoretical physics, and experimental physics. Johannes Kepler (1571–1630) explained planetary motions, formulating the first "natural laws" in the modern sense[29] Isaac Newton discovered the laws of motion and universal gravitation Further information: History_of_physics § 19th_century The discovery of laws in thermodynamics, chemistry, and electromagnetics resulted from research efforts during the Industrial Revolution as energy needs increased.[30] By the end of the 19th century, theories of thermodynamics, mechanics, and electromagnetics matched a wide variety of observations. Taken together these theories became the basis for what would later be called classical physics.[31]:2 A few experimental results remained inexplicable. Classical electromagnetism presumed a medium, an luminiferous aether to support the propagation of waves, but this medium could not be detected. The intensity of light from hot glowing blackbody objects did not match the predictions of thermodynamics and electromagnetism. The character of electron emission of illuminated metals differed from predictions. These failures, seemingly insignificant in the big picture would upset the physics world in first two decades of the 20th century.[31] See also: History of special relativity and History of quantum mechanics Further information: History of physics § 20th century: birth of modern physics Max Planck (1858–1947), proposed quanta to explain the blackbody spectrum,[32] originating quantum theory.[33][34] Albert Einstein (1879–1955), discovered the photoelectric effect and theory of relativity. Modern physics began in the early 20th century with the work of Max Planck in quantum theory and Albert Einstein's theory of relativity. Both of these theories came about due to inaccuracies in classical mechanics in certain situations. Classical mechanics predicted that the speed of light depends on the motion of the observer, which could not be resolved with the constant speed predicted by Maxwell's equations of electromagnetism. This discrepancy was corrected by Einstein's theory of special relativity, which replaced classical mechanics for fast-moving bodies and allowed for a constant speed of light.[35] Black-body radiation provided another problem for classical physics, which was corrected when Planck proposed that the excitation of material oscillators is possible only in discrete steps proportional to their frequency. This, along with the photoelectric effect and a complete theory predicting discrete energy levels of electron orbitals, led to the theory of quantum mechanics improving on classical physics at very small scales.[36] Quantum mechanics would come to be pioneered by Werner Heisenberg, Erwin Schrödinger and Paul Dirac.[36] From this early work, and work in related fields, the Standard Model of particle physics was derived.[37] Following the discovery of a particle with properties consistent with the Higgs boson at CERN in 2012,[38] all fundamental particles predicted by the standard model, and no others, appear to exist; however, physics beyond the Standard Model, with theories such as supersymmetry, is an active area of research.[39] Areas of mathematics in general are important to this field, such as the study of probabilities and groups. Further information: Outline of physics Physics deals with a wide variety of systems, although certain theories are used by all physicists. Each of these theories was experimentally tested numerous times and found to be an adequate approximation of nature. These central theories are important tools for research into more specialized topics, and any physicist, regardless of their specialization, is expected to be literate in them. These include classical mechanics, quantum mechanics, thermodynamics and statistical mechanics, electromagnetism, and special relativity. It has been suggested that this section be merged with Classical and modern physics. (Discuss) Proposed since February 2025. Further information: History_of_physics § Division_into_classical_and_modern Classical mechanics works for larger and slower objects; modern theories are needed otherwise. In the first decades of the 20th century physics was revolutionized by the discoveries of quantum mechanics and relativity. The changes were so fundamental that these new concepts became the foundation of "modern physics", with other topics becoming "classical physics". The majority of applications of physics are essentially classical.[40]:xxxi The laws of classical physics accurately describe systems whose important length scales are greater than the atomic scale and whose motions are much slower than the speed of light.[40]:xxxii Outside of this domain, observations do not match predictions provided by classical mechanics.[31]:6 Main article: Classical physics Classical physics includes the traditional branches and topics that were recognized and well-developed before the beginning of the 20th century—classical mechanics, thermodynamics, and electromagnetism.[31]:2 Classical mechanics is concerned with bodies acted on by forces and bodies in motion and may be divided into statics (study of the forces on a body or bodies not subject to an acceleration), kinematics (study of motion without regard to its causes), and dynamics (study of motion and the forces that affect it); mechanics may also be divided into solid mechanics and fluid mechanics (known together as continuum mechanics), the latter include such branches as hydrostatics, hydrodynamics and pneumatics. Acoustics is the study of how sound is produced, controlled, transmitted and received.[41] Important modern branches of acoustics include ultrasonics, the study of sound waves of very high frequency beyond the range of human hearing; bioacoustics, the physics of animal calls and hearing,[42] and electroacoustics, the manipulation of audible sound waves using electronics.[43] Optics, the study of light, is concerned not only with visible light but also with infrared and ultraviolet radiation, which exhibit all of the phenomena of visible light except visibility, e.g., reflection, refraction, interference, diffraction, dispersion, and polarization of light. Heat is a form of energy, the internal energy possessed by the particles of which a substance is composed; thermodynamics deals with the relationships between heat and other forms of energy. Electricity and magnetism have been studied as a single branch of physics since the intimate connection between them was discovered in the early 19th century; an electric current gives rise to a magnetic field, and a changing magnetic field induces an electric current. Electrostatics deals with electric charges at rest, electrodynamics with moving charges, and magnetostatics with magnetic poles at rest. Main article: Modern physics The discovery of relativity and of quantum mechanics in the first decades of the 20th century transformed the conceptual basis of physics without reducing the practical value of most of the physical theories developed up to that time. Consequently the topics of physics have come to be divided into "classical physics" and "modern physics", with the latter category including effects related to quantum mechanics and relativity.[31]:2 Classical physics is generally concerned with matter and energy on the normal scale of observation, while much of modern physics is concerned with the behavior of matter and energy under extreme conditions or on a very large or very small scale. For example, atomic and nuclear physics study matter on the smallest scale at which chemical elements can be identified. The physics of elementary particles is on an even smaller scale since it is concerned with the most basic units of matter; this branch of physics is also known as high-energy physics because of the extremely high energies necessary to produce many types of particles in particle accelerators. On this scale, ordinary, commonsensical notions of space, time, matter, and energy are no longer valid.[44] The two chief theories of modern physics present a different picture of the concepts of space, time, and matter from that presented by classical physics. Classical mechanics approximates nature as continuous, while quantum theory is concerned with the discrete nature of many phenomena at the atomic and subatomic level and with the complementary aspects of particles and waves in the description of such phenomena. The theory of relativity is concerned with the description of phenomena that take place in a frame of reference that is in motion with respect to an observer; the special theory of relativity is concerned with motion in the absence of gravitational fields and the general theory of relativity with motion and its connection with gravitation. Both quantum theory and the theory of relativity find applications in many areas of modern physics.[45] Fundamental concepts in modern physics include: Action Causality Covariance Particle Physical field Physical interaction Quantum Statistical ensemble Symmetry Wave Physicists use the scientific method to test the validity of a physical theory. By using a methodical approach to compare the implications of a theory with the conclusions drawn from its related experiments and observations, physicists are better able to test the validity of a theory in a logical, unbiased, and repeatable way. To that end, experiments are performed and observations are made in order to determine the validity or invalidity of a theory.[46] A scientific law is a concise verbal or mathematical statement of a relation that expresses a fundamental principle of some theory, such as Newton's law of universal gravitation.[47] Main articles: Theoretical physics and Experimental physics The astronaut and Earth are both in free fall. (Pictured: Astronaut Bruce McCandless.) Lightning is an electric current. Theorists seek to develop mathematical models that both agree with existing experiments and successfully predict future experimental results, while experimentalists devise and perform experiments to test theoretical predictions and explore new phenomena. Although theory and experiment are developed separately, they strongly affect and depend upon each other. Progress in physics frequently comes about when experimental results defy explanation by existing theories, prompting intense focus on applicable modelling, and when new theories generate experimentally testable predictions, which inspire the development of new experiments (and often related equipment).[48] Physicists who work at the interplay of theory and experiment are called phenomenologists, who study complex phenomena observed in experiment and work to relate them to a fundamental theory.[49] Theoretical physics has historically taken inspiration from philosophy; electromagnetism was unified this way.[a] Beyond the known universe, the field of theoretical physics also deals with hypothetical issues,[b] such as parallel universes, a multiverse, and higher dimensions. Theorists invoke these ideas in hopes of solving particular problems with existing theories; they then explore the consequences of these ideas and work toward making testable predictions. Experimental physics expands, and is expanded by, engineering and technology. Experimental physicists who are involved in basic research design and perform experiments with equipment such as particle accelerators and lasers, whereas those involved in applied research often work in industry, developing technologies such as magnetic resonance imaging (MRI) and transistors. Feynman has noted that experimentalists may seek areas that have not been explored well by theorists.[50] Physics involves modeling the natural world with theory, usually quantitative. Here, the path of a particle is modeled with the mathematics of calculus to explain its behavior: the purview of the branch of physics known as mechanics. Physics covers a wide range of phenomena, from elementary particles (such as quarks, neutrinos, and electrons) to the largest superclusters of galaxies. Included in these phenomena are the most basic objects composing all other things. Therefore, physics is sometimes called the "fundamental science".[51] Physics aims to describe the various phenomena that occur in nature in terms of simpler phenomena. Thus, physics aims to both connect the things observable to humans to root causes, and then connect these causes together. For example, the ancient Chinese observed that certain rocks (lodestone and magnetite) were attracted to one another by an invisible force. This effect was later called magnetism, which was first rigorously studied in the 17th century. But even before the Chinese discovered magnetism, the ancient Greeks knew of other objects such as amber, that when rubbed with fur would cause a similar invisible attraction between the two.[52] This was also first studied rigorously in the 17th century and came to be called electricity. Thus, physics had come to understand two observations of nature in terms of some root cause (electricity and magnetism). However, further work in the 19th century revealed that these two forces were just two different aspects of one force—electromagnetism. This process of "unifying" forces continues today, and electromagnetism and the weak nuclear force are now considered to be two aspects of the electroweak interaction. Physics hopes to find an ultimate reason (theory of everything) for why nature is as it is (see section Current research below for more information).[53] Further information: List of unsolved problems in physics Feynman diagram signed by R. P. Feynman A typical phenomenon described by physics: a magnet levitating above a superconductor demonstrates the Meissner effect. Research in physics is continually progressing on a large number of fronts. In condensed matter physics, an important unsolved theoretical problem is that of high-temperature superconductivity.[54] Many condensed matter experiments are aiming to fabricate workable spintronics and quantum computers.[55][56] In particle physics, the first pieces of experimental evidence for physics beyond the Standard Model have begun to appear. Foremost among these are indications that neutrinos have non-zero mass. These experimental results appear to have solved the long-standing solar neutrino problem, and the physics of massive neutrinos remains an area of active theoretical and experimental research. The Large Hadron Collider has already found the Higgs boson, but future research aims to prove or disprove the supersymmetry, which extends the Standard Model of particle physics. Research on the nature of the major mysteries of dark matter and dark energy is also currently ongoing.[57] Although much progress has been made in high-energy, quantum, and astronomical physics, many everyday phenomena involving complexity,[58] chaos,[59] or turbulence[60] are still poorly understood. Complex problems that seem like they could be solved by a clever application of dynamics and mechanics remain unsolved; examples include the formation of sandpiles, nodes in trickling water, the shape of water droplets, mechanisms of surface tension catastrophes, and self-sorting in shaken heterogeneous collections.[c][61] These complex phenomena have received growing attention since the 1970s for several reasons, including the availability of modern mathematical methods and computers, which enabled complex systems to be modeled in new ways. Complex physics has become part of increasingly interdisciplinary research, as exemplified by the study of turbulence in aerodynamics and the observation of pattern formation in biological systems. In the 1932 Annual Review of Fluid Mechanics, Horace Lamb said:[62] I am an old man now, and when I die and go to heaven there are two matters on which I hope for enlightenment. One is quantum electrodynamics, and the other is the turbulent motion of fluids. And about the former I am rather optimistic. This section is an excerpt from Branches of physics.[edit] Branches of physics include classical mechanics; thermodynamics and statistical mechanics; electromagnetism and photonics; relativity; quantum mechanics, atomic physics, and molecular physics; optics and acoustics; condensed matter physics; high-energy particle physics and nuclear physics; and chaos theory and cosmology; and interdisciplinary fields. The major fields of physics, along with their subfields and the theories and concepts they employ, are shown in the following table. Field Subfields Major theories Concepts Nuclear and particle physics Nuclear physics, Nuclear astrophysics, Particle physics, Astroparticle physics, Particle physics phenomenology Standard Model, Quantum field theory, Quantum electrodynamics, Quantum chromodynamics, Electroweak theory, Effective field theory, Lattice field theory, Gauge theory, Supersymmetry, Grand Unified Theory, Superstring theory, M-theory, AdS/CFT correspondence Fundamental interaction (gravitational, electromagnetic, weak, strong), Elementary particle, Spin, Antimatter, Spontaneous symmetry breaking, Neutrino oscillation, Seesaw mechanism, Brane, String, Quantum gravity, Theory of everything, Vacuum energy Atomic, molecular, and optical physics Atomic physics, Molecular physics, Atomic and molecular astrophysics, Chemical physics, Optics, Photonics Quantum optics, Quantum chemistry, Quantum information science Photon, Atom, Molecule, Diffraction, Electromagnetic radiation, Laser, Polarization (waves), Spectral line, Casimir effect Condensed matter physics Solid-state physics, High-pressure physics, Low-temperature physics, Surface physics, Nanoscale and mesoscopic physics, Polymer physics BCS theory, Bloch's theorem, Density functional theory, Fermi gas, Fermi liquid theory, Many-body theory, Statistical mechanics Phases (gas, liquid, solid), Bose–Einstein condensate, Electrical conduction, Phonon, Magnetism, Self-organization, Semiconductor, superconductor, superfluidity, Spin Astrophysics Astronomy, Astrometry, Cosmology, Gravitation physics, High-energy astrophysics, Planetary astrophysics, Plasma physics, Solar physics, Space physics, Stellar astrophysics Big Bang, Cosmic inflation, General relativity, Newton's law of universal gravitation, Lambda-CDM model, Magnetohydrodynamics Black hole, Cosmic background radiation, Cosmic string, Cosmos, Dark energy, Dark matter, Galaxy, Gravity, Gravitational radiation, Gravitational singularity, Planet, Solar System, Star, Supernova, Universe Applied physics Accelerator physics, Acoustics, Agrophysics, Atmospheric physics, Biophysics, Chemical physics, Communication physics, Econophysics, Engineering physics, Fluid dynamics, Geophysics, Laser physics, Materials physics, Medical physics, Nanotechnology, Optics, Optoelectronics, Photonics, Photovoltaics, Physical chemistry, Physical oceanography, Physics of computation, Plasma physics, Solid-state devices, Quantum chemistry, Quantum electronics, Quantum information science, Vehicle dynamics Since the 20th century, the individual fields of physics have become increasingly specialised, and today most physicists work in a single field for their entire careers. "Universalists" such as Einstein (1879–1955) and Lev Landau (1908–1968), who worked in multiple fields of physics, are now very rare.[d] Contemporary research in physics can be broadly divided into nuclear and particle physics; condensed matter physics; atomic, molecular, and optical physics; astrophysics; and applied physics. Some physics departments also support physics education research and physics outreach.[63] Main articles: Particle physics and Nuclear physics A simulated event in the CMS detector of the Large Hadron Collider, featuring a possible appearance of the Higgs boson Particle physics is the study of the elementary constituents of matter and energy and the interactions between them.[64] In addition, particle physicists design and develop the high-energy accelerators,[65] detectors,[66] and computer programs[67] necessary for this research. The field is also called "high-energy physics" because many elementary particles do not occur naturally but are created only during high-energy collisions of other particles.[68] Currently, the interactions of elementary particles and fields are described by the Standard Model.[69] The model accounts for the 12 known particles of matter (quarks and leptons) that interact via the strong, weak, and electromagnetic fundamental forces.[69] Dynamics are described in terms of matter particles exchanging gauge bosons (gluons, W and Z bosons, and photons, respectively).[70] The Standard Model also predicts a particle known as the Higgs boson.[69] In July 2012 CERN, the European laboratory for particle physics, announced the detection of a particle consistent with the Higgs boson,[71] an integral part of the Higgs mechanism. Nuclear physics is the field of physics that studies the constituents and interactions of atomic nuclei. The most commonly known applications of nuclear physics are nuclear power generation and nuclear weapons technology, but the research has provided application in many fields, including those in nuclear medicine and magnetic resonance imaging, ion implantation in materials engineering, and radiocarbon dating in geology and archaeology. Main article: Atomic, molecular, and optical physics Atomic, molecular, and optical physics (AMO) is the study of matter—matter and light—matter interactions on the scale of single atoms and molecules. The three areas are grouped together because of their interrelationships, the similarity of methods used, and the commonality of their relevant energy scales. All three areas include both classical, semi-classical and quantum treatments; they can treat their subject from a microscopic view (in contrast to a macroscopic view). Atomic physics studies the electron shells of atoms. Current research focuses on activities in quantum control, cooling and trapping of atoms and ions,[72][73][74] low-temperature collision dynamics and the effects of electron correlation on structure and dynamics. Atomic physics is influenced by the nucleus (see hyperfine splitting), but intra-nuclear phenomena such as fission and fusion are considered part of nuclear physics. Molecular physics focuses on multi-atomic structures and their internal and external interactions with matter and light. Optical physics is distinct from optics in that it tends to focus not on the control of classical light fields by macroscopic objects but on the fundamental properties of optical fields and their interactions with matter in the microscopic realm. Main article: Condensed matter physics Velocity-distribution data of a gas of rubidium atoms, confirming the discovery of a new phase of matter, the Bose–Einstein condensate Condensed matter physics is the field of physics that deals with the macroscopic physical properties of matter.[75][76] In particular, it is concerned with the "condensed" phases that appear whenever the number of particles in a system is extremely large and the interactions between them are strong.[55] The most familiar examples of condensed phases are solids and liquids, which arise from the bonding by way of the electromagnetic force between atoms.[77] More exotic condensed phases include the superfluid[78] and the Bose–Einstein condensate[79] found in certain atomic systems at very low temperature, the superconducting phase exhibited by conduction electrons in certain materials,[80] and the ferromagnetic and antiferromagnetic phases of spins on atomic lattices.[81] Condensed matter physics is the largest field of contemporary physics. Historically, condensed matter physics grew out of solid-state physics, which is now considered one of its main subfields.[82] The term condensed matter physics was apparently coined by Philip Anderson when he renamed his research group—previously solid-state theory—in 1967.[83] In 1978, the Division of Solid State Physics of the American Physical Society was renamed as the Division of Condensed Matter Physics.[82] Condensed matter physics has a large overlap with chemistry, materials science, nanotechnology and engineering.[55] Main articles: Astrophysics and Physical cosmology The deepest visible-light image of the universe, the Hubble Ultra-Deep Field. The vast majority of objects seen above are distant galaxies. Astrophysics and astronomy are the application of the theories and methods of physics to the study of stellar structure, stellar evolution, the origin of the Solar System, and related problems of cosmology. Because astrophysics is a broad subject, astrophysicists typically apply many disciplines of physics, including mechanics, electromagnetism, statistical mechanics, thermodynamics, quantum mechanics, relativity, nuclear and particle physics, and atomic and molecular physics.[84] The discovery by Karl Jansky in 1931 that radio signals were emitted by celestial bodies initiated the science of radio astronomy. Most recently, the frontiers of astronomy have been expanded by space exploration. Perturbations and interference from the Earth's atmosphere make space-based observations necessary for infrared, ultraviolet, gamma-ray, and X-ray astronomy. Physical cosmology is the study of the formation and evolution of the universe on its largest scales. Albert Einstein's theory of relativity plays a central role in all modern cosmological theories. In the early 20th century, Hubble's discovery that the universe is expanding, as shown by the Hubble diagram, prompted rival explanations known as the steady state universe and the Big Bang. The Big Bang was confirmed by the success of Big Bang nucleosynthesis and the discovery of the cosmic microwave background in 1964. The Big Bang model rests on two theoretical pillars: Albert Einstein's general relativity and the cosmological principle. Cosmologists have recently established the ΛCDM model of the evolution of the universe, which includes cosmic inflation, dark energy, and dark matter. This section is an excerpt from Physics education.[edit] Physics education or physics teaching refers to the education methods currently used to teach physics. The occupation is called physics educator or physics teacher. Physics education research refers to an area of pedagogical research that seeks to improve those methods. Historically, physics has been taught at the high school and college level primarily by the lecture method together with laboratory exercises aimed at verifying concepts taught in the lectures. These concepts are better understood when lectures are accompanied with demonstration, hand-on experiments, and questions that require students to ponder what will happen in an experiment and why. Students who participate in active learning for example with hands-on experiments learn through self-discovery. By trial and error they learn to change their preconceptions about phenomena in physics and discover the underlying concepts. Physics education is part of the broader area of science education. This section is an excerpt from Physicist.[edit] A physicist is a scientist who specializes in the field of physics, which encompasses the interactions of matter and energy at all length and time scales in the physical universe.[85][86] Physicists generally are interested in the root or ultimate causes of phenomena, and usually frame their understanding in mathematical terms. They work across a wide range of research fields, spanning all length scales: from sub-atomic and particle physics, through biological physics, to cosmological length scales encompassing the universe as a whole. The field generally includes two types of physicists: experimental physicists who specialize in the observation of natural phenomena and the development and analysis of experiments, and theoretical physicists who specialize in mathematical modeling of physical systems to rationalize, explain and predict natural phenomena.[85] Physicists can apply their knowledge towards solving practical problems or to developing new technologies (also known as applied physics or engineering physics).[87][88][89] Main article: Philosophy of physics Physics, as with the rest of science, relies on the philosophy of science and its "scientific method" to advance knowledge of the physical world.[90] The scientific method employs a priori and a posteriori reasoning as well as the use of Bayesian inference to measure the validity of a given theory.[91] Study of the philosophical issues surrounding physics, the philosophy of physics, involves issues such as the nature of space and time, determinism, and metaphysical outlooks such as empiricism, naturalism, and realism.[92] Many physicists have written about the philosophical implications of their work, for instance Laplace, who championed causal determinism,[93] and Erwin Schrödinger, who wrote on quantum mechanics.[94][95] The mathematical physicist Roger Penrose has been called a Platonist by Stephen Hawking,[96] a view Penrose discusses in his book, The Road to Reality.[97] Hawking referred to himself as an "unashamed reductionist" and took issue with Penrose's views.[98] This parabola-shaped lava flow illustrates an application of mathematics in physics — in this case, Galileo's law of falling bodies. Mathematics and ontology are used in physics. Physics is used in chemistry and cosmology. Mathematics provides a compact and exact language used to describe the order in nature. This was noted and advocated by Pythagoras,[99] Plato,[100] Galileo,[101] and Newton. Some theorists, like Hilary Putnam and Penelope Maddy, hold that logical truths, and therefore mathematical reasoning, depend on the empirical world. This is usually combined with the claim that the laws of logic express universal regularities found in the structural features of the world, which may explain the peculiar relation between these fields. Physics uses mathematics[102] to organise and formulate experimental results. From those results, precise or estimated solutions are obtained, or quantitative results, from which new predictions can be made and experimentally confirmed or negated. The results from physics experiments are numerical data, with their units of measure and estimates of the errors in the measurements. Technologies based on mathematics, like computation have made computational physics an active area of research. The distinction between mathematics and physics is clear-cut, but not always obvious, especially in mathematical physics. Ontology is a prerequisite for physics, but not for mathematics. It means physics is ultimately concerned with descriptions of the real world, while mathematics is concerned with abstract patterns, even beyond the real world. Thus physics statements are synthetic, while mathematical statements are analytic. Mathematics contains hypotheses, while physics contains theories. Mathematics statements have to be only logically true, while predictions of physics statements must match observed and experimental data. The distinction is clear-cut, but not always obvious. For example, mathematical physics is the application of mathematics in physics. Its methods are mathematical, but its subject is physical.[103] The problems in this field start with a "mathematical model of a physical situation" (system) and a "mathematical description of a physical law" that will be applied to that system. Every mathematical statement used for solving has a hard-to-find physical meaning. The final mathematical solution has an easier-to-find meaning, because it is what the solver is looking for.[clarification needed] Main article: Applied physics Physics is a branch of fundamental science (also called basic science). Physics is also called "the fundamental science" because all branches of natural science including chemistry, astronomy, geology, and biology are constrained by laws of physics.[51] Similarly, chemistry is often called the central science because of its role in linking the physical sciences. For example, chemistry studies properties, structures, and reactions of matter (chemistry's focus on the molecular and atomic scale distinguishes it from physics). Structures are formed because particles exert electrical forces on each other, properties include physical characteristics of given substances, and reactions are bound by laws of physics, like conservation of energy, mass, and charge. Fundamental physics seeks to better explain and understand phenomena in all spheres, without a specific practical application as a goal, other than the deeper insight into the phenomema themselves. An acoustic engineering model of sound reflecting from an acoustic diffuser, implemented with classical physics Archimedes' screw, a simple machine for lifting Applied physics is a general term for physics research and development that is intended for a particular use. An applied physics curriculum usually contains a few classes in an applied discipline, like geology or electrical engineering. It usually differs from engineering in that an applied physicist may not be designing something in particular, but rather is using physics or conducting physics research with the aim of developing new technologies or solving a problem. The approach is similar to that of applied mathematics. Applied physicists use physics in scientific research. For instance, people working on accelerator physics might seek to build better particle detectors for research in theoretical physics. Physics is used heavily in engineering. For example, statics, a subfield of mechanics, is used in the building of bridges and other static structures. The understanding and use of acoustics results in sound control and better concert halls; similarly, the use of optics creates better optical devices. An understanding of physics makes for more realistic flight simulators, video games, and movies, and is often critical in forensic investigations. Experiment using a laser With the standard consensus that the laws of physics are universal and do not change with time, physics can be used to study things that would ordinarily be mired in uncertainty. For example, in the study of the origin of the Earth, a physicist can reasonably model Earth's mass, temperature, and rate of rotation, as a function of time allowing the extrapolation forward or backward in time and so predict future or prior events. It also allows for simulations in engineering that speed up the development of a new technology. There is also considerable interdisciplinarity, so many other important fields are influenced by physics (e.g., the fields of econophysics and sociophysics). Physics portal Earth science – Fields of natural science related to Earth Neurophysics – Study of the nervous system with physics Psychophysics – Branch of knowledge relating physical stimuli and psychological perception Relationship between mathematics and physics Science tourism – Travel to notable science locations List of important publications in physics List of physicists Lists of physics equations

^ See, for example, the influence of Kant and Ritter on Ørsted. ^ Concepts which are denoted hypothetical can change with time. For example, the atom of nineteenth-century physics was denigrated by some, including Ernst Mach's critique of Ludwig Boltzmann's formulation of statistical mechanics. By the end of World War II, the atom was no longer deemed hypothetical. ^ See the work of Ilya Prigogine, on 'systems far from equilibrium', and others. ^ Yet, universalism is encouraged in the culture of physics. For example, the World Wide Web, which was innovated at CERN by Tim Berners-Lee, was created in service to the computer infrastructure of CERN, and was/is intended for use by physicists worldwide. The same might be said for arXiv.org ^ Maxwell 1878, p. 9 "Physical science is that department of knowledge which relates to the order of nature, or, in other words, to the regular succession of events." ^ a b c Young & Freedman 2014, p. 1 "Physics is one of the most fundamental of the sciences. Scientists of all disciplines use the ideas of physics, including chemists who study the structure of molecules, paleontologists who try to reconstruct how dinosaurs walked, and climatologists who study how human activities affect the atmosphere and oceans. Physics is also the foundation of all engineering and technology. No engineer could design a flat-screen TV, an interplanetary spacecraft, or even a better mousetrap without first understanding the basic laws of physics. (...) You will come to see physics as a towering achievement of the human intellect in its quest to understand our world and ourselves." ^ Young & Freedman 2014, p. 2 "Physics is an experimental science. Physicists observe the phenomena of nature and try to find patterns that relate these phenomena." ^ Holzner 2006, p. 7 "Physics is the study of your world and the world and universe around you." ^ a b Krupp 2003 ^ "physics". Online Etymology Dictionary. Archived from the original on 24 December 2016. Retrieved 1 November 2016. ^ "physic". Online Etymology Dictionary. Archived from the original on 24 December 2016. Retrieved 1 November 2016. ^ φύσις, φυσική, ἐπιστήμη. Liddell, Henry George; Scott, Robert; A Greek–English Lexicon at the Perseus Project ^ Aaboe 1991 ^ Clagett 1995 ^ Thurston 1994 ^ Singer 2008, p. 35 ^ Lloyd 1970, pp. 108–109 ^ Gill, N. S. "Atomism – Pre-Socratic Philosophy of Atomism". About Education. Archived from the original on 10 July 2014. Retrieved 1 April 2014. ^ "Daily 40 no. 2 – Aristotle and the Four Simple Bodies and Elements" (PDF). Cal State LA. Archived from the original (PDF) on 6 January 2023. Retrieved 27 September 2023. ^ tbcaldwe (14 October 2012). "Natural Philosophy: Aristotle | Physics 139". Retrieved 17 December 2022. ^ a b "Aristotle". galileoandeinstein.phys.virginia.edu. Retrieved 17 December 2022. ^ Smith 2001, Book I [6.85], [6.86], p. 379; Book II, [3.80], p. 453. ^ Lindberg 1992, p. 363. ^ Wildberg, Christian (2021). Zalta, Edward N. (ed.). "John Philoponus". Metaphysics Research Lab, Stanford University. Retrieved 6 February 2025. ^ Dallal, Ahmad (2010). Islam, Science, and the Challenge of History. New Haven: Yale University Press. p. 38. Within two centuries, the field of optics was radically transformed ^ Tbakhi, Abdelghani; Amr, Samir S. (2007). "Ibn Al-Haytham: Father of Modern Optics". Annals of Saudi Medicine. 27 (6): 464–467. doi:10.5144/0256-4947.2007.464. ISSN 0256-4947. PMC 6074172. PMID 18059131. ^ Al-Khalili, Jim (February 2015). "In retrospect: Book of Optics". Nature. 518 (7538): 164–165. Bibcode:2015Natur.518..164A. doi:10.1038/518164a. ISSN 1476-4687. ^ Howard & Rogers 1995, pp. 6–7 ^ Ben-Chaim 2004 ^ Guicciardini 1999 ^ See also Leibniz–Newton calculus controversy. Blank, Brian E. (May 2009). "The Calculus Wars reviewed by Brian E. Blank" (PDF). Notices of the American Mathematical Society. 56 (5): 602–610. ^ Allen 1997 ^ Gould, Alan (24 September 2016). "Johannes Kepler: His Life, His Laws and Times". NASA. Archived from the original on 24 June 2021. Retrieved 25 February 2025. ^ "The Industrial Revolution". Schoolscience.org, Institute of Physics. Archived from the original on 7 April 2014. Retrieved 1 April 2014. ^ a b c d e Krane, Kenneth S. (2020). Modern physics (4 ed.). Hoboken, New Jersey: John Wiley & Sons, Inc. ISBN 978-1-119-49548-2. ^ "Max Planck: Originator of quantum theory". esa.int. 12 August 2012. Retrieved 4 March 2025. He renounced previous physics and introduced the concept of 'quanta' of energy. ^ "Max Planck: Originator of quantum theory". www.esa.int. ^ "Max Planck | Biography, Discoveries, & Quantum Theory | Britannica". www.britannica.com. 19 April 2025. ^ O'Connor & Robertson 1996a ^ a b O'Connor & Robertson 1996b ^ "The Standard Model". DONUT. Fermilab. 29 June 2001. Archived from the original on 31 May 2014. Retrieved 1 April 2014. ^ Cho 2012 ^ Womersley, J. (February 2005). "Beyond the Standard Model" (PDF). Symmetry. Vol. 2, no. 1. pp. 22–25. Archived (PDF) from the original on 24 September 2015. ^ a b Thorne, Kip S.; Blandford, R.D. (2017). Modern Classical Physics Optics, Fluids, Plasmas, Elasticity, Relativity, and Statistical Physics. United States: Princeton University Press. ^ "acoustics". Encyclopædia Britannica. Archived from the original on 18 June 2013. Retrieved 14 June 2013. ^ "Bioacoustics – the International Journal of Animal Sound and its Recording". Taylor & Francis. Archived from the original on 5 September 2012. Retrieved 31 July 2012. ^ "Acoustics and You (A Career in Acoustics?)". Acoustical Society of America. Archived from the original on 4 September 2015. Retrieved 21 May 2013. ^ Tipler & Llewellyn 2003, pp. 269, 477, 561 ^ Tipler & Llewellyn 2003, pp. 1–4, 115, 185–187 ^ Ellis, G.; Silk, J. (16 December 2014). "Scientific method: Defend the integrity of physics". Nature. 516 (7531): 321–323. Bibcode:2014Natur.516..321E. doi:10.1038/516321a. PMID 25519115. ^ Honderich 1995, pp. 474–476 ^ "Has theoretical physics moved too far away from experiments? Is the field entering a crisis and, if so, what should we do about it?". Perimeter Institute for Theoretical Physics. June 2015. Archived from the original on 21 April 2016. ^ "Phenomenology". Max Planck Institute for Physics. Archived from the original on 7 March 2016. Retrieved 22 October 2016. ^ Feynman 1965, p. 157 "In fact experimenters have a certain individual character. They ... very often do their experiments in a region in which people know the theorist has not made any guesses." ^ a b The Feynman Lectures on Physics Vol. I Ch. 3: The Relation of Physics to Other Sciences; see also reductionism and special sciences ^ Stewart, J. (2001). Intermediate Electromagnetic Theory. World Scientific. p. 50. ISBN 978-981-02-4471-2. ^ Weinberg, S. (1993). Dreams of a Final Theory: The Search for the Fundamental Laws of Nature. Hutchinson Radius. ISBN 978-0-09-177395-3. ^ Leggett, A. J. (2006). "What DO we know about high Tc?" (PDF). Nature Physics. 2 (3): 134–136. Bibcode:2006NatPh...2..134L. doi:10.1038/nphys254. S2CID 122055331. Archived from the original (PDF) on 10 June 2010. ^ a b c Cohen 2008 ^ Wolf, S. A.; Chtchelkanova, A. Y.; Treger, D. M. (2006). "Spintronics – A retrospective and perspective" (PDF). IBM Journal of Research and Development. 50: 101–110. doi:10.1147/rd.501.0101. S2CID 41178069. Archived from the original (PDF) on 24 September 2020. ^ Gibney, E. (2015). "LHC 2.0: A new view of the Universe". Nature. 519 (7542): 142–143. Bibcode:2015Natur.519..142G. doi:10.1038/519142a. PMID 25762263. ^ National Research Council & Committee on Technology for Future Naval Forces 1997, p. 161 ^ Kellert 1993, p. 32 ^ Eames, I.; Flor, J. B. (2011). "New developments in understanding interfacial processes in turbulent flows". Philosophical Transactions of the Royal Society A. 369 (1937): 702–705. Bibcode:2011RSPTA.369..702E. doi:10.1098/rsta.2010.0332. PMID 21242127. Richard Feynman said that 'Turbulence is the most important unsolved problem of classical physics' ^ National Research Council (2007). "What happens far from equilibrium and why". Condensed-Matter and Materials Physics: the science of the world around us. pp. 91–110. doi:10.17226/11967. ISBN 978-0-309-10969-7. Archived from the original on 4 November 2016.– Jaeger, Heinrich M.; Liu, Andrea J. (2010). "Far-From-Equilibrium Physics: An Overview". arXiv:1009.4874 [cond-mat.soft]. ^ Goldstein 1969 ^ Redish, E. "Science and Physics Education Homepages". University of Maryland Physics Education Research Group. Archived from the original on 28 July 2016. ^ "Division of Particles & Fields". American Physical Society. Archived from the original on 29 August 2016. Retrieved 18 October 2012. ^ Halpern 2010 ^ Grupen 1999 ^ Walsh 2012 ^ "High Energy Particle Physics Group". Institute of Physics. Archived from the original on 29 May 2019. Retrieved 18 October 2012. ^ a b c Oerter 2006 ^ Gribbin, Gribbin & Gribbin 1998 ^ "CERN experiments observe particle consistent with long-sought Higgs boson". CERN. 4 July 2012. Archived from the original on 14 November 2012. Retrieved 18 October 2012. ^ "Atomic, Molecular, and Optical Physics". MIT Department of Physics. Archived from the original on 27 February 2014. Retrieved 21 February 2014. ^ "Korea University, Physics AMO Group". Archived from the original on 1 March 2014. Retrieved 21 February 2014. ^ "Aarhus Universitet, AMO Group". Archived from the original on 7 March 2014. Retrieved 21 February 2014. ^ Taylor & Heinonen 2002 ^ Girvin, Steven M.; Yang, Kun (28 February 2019). Modern Condensed Matter Physics. Cambridge University Press. ISBN 978-1-108-57347-4. Archived from the original on 25 February 2021. Retrieved 23 August 2020. ^ Moore 2011, pp. 255–258 ^ Leggett 1999 ^ Levy 2001 ^ Stajic, Coontz & Osborne 2011 ^ Mattis 2006 ^ a b "History of Condensed Matter Physics". American Physical Society. Archived from the original on 12 September 2011. Retrieved 31 March 2014. ^ "Philip Anderson". Princeton University, Department of Physics. Archived from the original on 8 October 2011. Retrieved 15 October 2012. ^ "BS in Astrophysics". University of Hawaii at Manoa. Archived from the original on 4 April 2016. Retrieved 14 October 2016. ^ a b Rosen, Joe (2009). Encyclopedia of Physics. Infobase Publishing. p. 247. ^ "physicist". Merriam-Webster.com Dictionary. Merriam-Webster. "a scientist who studies or is a specialist in physics" ^ "Industrial Physicists: Primarily specializing in Physics" (PDF). American Institute for Physics. October 2016. ^ "Industrial Physicists: Primarily specializing in Engineering" (PDF). American Institute for Physics. October 2016. ^ "Industrial Physicists: Primarily specializing outside of STEM sectors" (PDF). American Institute for Physics. October 2016. ^ Rosenberg 2006, Chapter 1 ^ Godfrey-Smith 2003, Chapter 14: "Bayesianism and Modern Theories of Evidence" ^ Godfrey-Smith 2003, Chapter 15: "Empiricism, Naturalism, and Scientific Realism?" ^ Laplace 1951 ^ Schrödinger 1983 ^ Schrödinger 1995 ^ Hawking & Penrose 1996, p. 4. "I think that Roger is a Platonist at heart but he must answer for himself." ^ Penrose 2004 ^ Penrose et al. 1997 ^ Dijksterhuis 1986 ^ Mastin 2010 "Although usually remembered today as a philosopher, Plato was also one of ancient Greece's most important patrons of mathematics. Inspired by Pythagoras, he founded his Academy in Athens in 387 BC, where he stressed mathematics as a way of understanding more about reality. In particular, he was convinced that geometry was the key to unlocking the secrets of the universe. The sign above the Academy entrance read: 'Let no-one ignorant of geometry enter here.'" ^ Toraldo Di Francia 1976, p. 10 'Philosophy is written in that great book which ever lies before our eyes. I mean the universe, but we cannot understand it if we do not first learn the language and grasp the symbols in which it is written. This book is written in the mathematical language, and the symbols are triangles, circles, and other geometrical figures, without whose help it is humanly impossible to comprehend a single word of it, and without which one wanders in vain through a dark labyrinth.' – Galileo (1623), The Assayer" ^ "Applications of Mathematics to the Sciences". 25 January 2000. Archived from the original on 10 May 2015. Retrieved 30 January 2012. ^ "Journal of Mathematical Physics". Archived from the original on 18 August 2014. Retrieved 31 March 2014. [Journal of Mathematical Physics] purpose is the publication of papers in mathematical physics—that is, the application of mathematics to problems in physics and the development of mathematical methods suitable for such applications and for the formulation of physical theories. Aaboe, A. (1991). "Mesopotamian Mathematics, Astronomy, and Astrology". The Cambridge Ancient History. Vol. III (2nd ed.). Cambridge University Press. ISBN 978-0-521-22717-9. Allen, D. (10 April 1997). "Calculus". Texas A&M University. Archived from the original on 23 March 2021. Retrieved 1 April 2014. Ben-Chaim, M. (2004). Experimental Philosophy and the Birth of Empirical Science: Boyle, Locke and Newton. Aldershot: Ashgate Publishing. ISBN 978-0-7546-4091-2. OCLC 53887772. Cho, A. (13 July 2012). "Higgs Boson Makes Its Debut After Decades-Long Search". Science. 337 (6091): 141–143. Bibcode:2012Sci...337..141C. doi:10.1126/science.337.6091.141. PMID 22798574. Clagett, M. (1995). Ancient Egyptian Science. Vol. 2. Philadelphia: American Philosophical Society. Cohen, M.L. (2008). "Fifty Years of Condensed Matter Physics". Physical Review Letters. 101 (5): 25001–25006. Bibcode:2008PhRvL.101y0001C. doi:10.1103/PhysRevLett.101.250001. PMID 19113681. Dijksterhuis, E.J. (1986). The mechanization of the world picture: Pythagoras to Newton. Princeton, New Jersey: Princeton University Press. ISBN 978-0-691-08403-9. Archived from the original on 5 August 2011. Feynman, R.P.; Leighton, R.B.; Sands, M. (1963). The Feynman Lectures on Physics. Vol. 1. Addison-Wesley. ISBN 978-0-201-02116-5. {{cite book}}: ISBN / Date incompatibility (help) Feynman, R.P. (1965). The Character of Physical Law. M.I.T. Press. ISBN 978-0-262-56003-0. Godfrey-Smith, P. (2003). Theory and Reality: An Introduction to the Philosophy of Science. University of Chicago Press. ISBN 978-0-226-30063-4. Goldstein, S. (1969). "Fluid Mechanics in the First Half of this Century". Annual Review of Fluid Mechanics. 1 (1): 1–28. Bibcode:1969AnRFM...1....1G. doi:10.1146/annurev.fl.01.010169.000245. Gribbin, J.R.; Gribbin, M.; Gribbin, J. (1998). Q is for Quantum: An Encyclopedia of Particle Physics. Free Press. Bibcode:1999qqep.book.....G. ISBN 978-0-684-85578-3. Grupen, Klaus (10 July 1999). "Instrumentation in Elementary Particle Physics: VIII ICFA School". AIP Conference Proceedings. 536: 3–34. arXiv:physics/9906063. Bibcode:2000AIPC..536....3G. doi:10.1063/1.1361756. S2CID 119476972. Guicciardini, N. (1999). Reading the Principia: The Debate on Newton's Methods for Natural Philosophy from 1687 to 1736. New York: Cambridge University Press. ISBN 978-0521640664. Halpern, P. (2010). Collider: The Search for the World's Smallest Particles. John Wiley & Sons. ISBN 978-0-470-64391-4. Hawking, S.; Penrose, R. (1996). The Nature of Space and Time. Princeton University Press. ISBN 978-0-691-05084-3. Holzner, S. (2006). Physics for Dummies. John Wiley & Sons. Bibcode:2005pfd..book.....H. ISBN 978-0-470-61841-7. Physics is the study of your world and the world and universe around you. Honderich, T., ed. (1995). The Oxford Companion to Philosophy (1 ed.). Oxford: Oxford University Press. pp. 474–476. ISBN 978-0-19-866132-0. Howard, Ian; Rogers, Brian (1995). Binocular Vision and Stereopsis. Oxford University Press. ISBN 978-0-19-508476-4. Kellert, S.H. (1993). In the Wake of Chaos: Unpredictable Order in Dynamical Systems. University of Chicago Press. ISBN 978-0-226-42976-2. Kerr, R.A. (16 October 2009). "Tying Up the Solar System With a Ribbon of Charged Particles". Science. 326 (5951): 350–351. doi:10.1126/science.326_350a. PMID 19833930. Krupp, E.C. (2003). Echoes of the Ancient Skies: The Astronomy of Lost Civilizations. Dover Publications. ISBN 978-0-486-42882-6. Retrieved 31 March 2014. Laplace, P.S. (1951). A Philosophical Essay on Probabilities. Translated from the 6th French edition by Truscott, F.W. and Emory, F.L. New York: Dover Publications. Leggett, A.J. (1999). "Superfluidity". Reviews of Modern Physics. 71 (2): S318 – S323. Bibcode:1999RvMPS..71..318L. doi:10.1103/RevModPhys.71.S318. Levy, Barbara G. (December 2001). "Cornell, Ketterle, and Wieman Share Nobel Prize for Bose-Einstein Condensates". Physics Today. 54 (12): 14. Bibcode:2001PhT....54l..14L. doi:10.1063/1.1445529. Lindberg, David (1992). The Beginnings of Western Science. University of Chicago Press. Lloyd, G.E.R. (1970). Early Greek Science: Thales to Aristotle. London; New York: Chatto and Windus; W. W. Norton & Company. ISBN 978-0-393-00583-7. Mastin, Luke (2010). "Plato". lukemastin.com. Mattis, D.C. (2006). The Theory of Magnetism Made Simple. World Scientific. ISBN 978-981-238-579-6. Maxwell, J.C. (1878). Matter and Motion. D. Van Nostrand. ISBN 978-0-486-66895-6. matter and motion. {{cite book}}: ISBN / Date incompatibility (help) Moore, J.T. (2011). Chemistry For Dummies (2 ed.). John Wiley & Sons. ISBN 978-1-118-00730-3. National Research Council; Committee on Technology for Future Naval Forces (1997). Technology for the United States Navy and Marine Corps, 2000–2035 Becoming a 21st-Century Force: Volume 9: Modeling and Simulation. Washington, DC: The National Academies Press. ISBN 978-0-309-05928-2. O'Connor, J.J.; Robertson, E.F. (February 1996a). "Special Relativity". MacTutor History of Mathematics archive. University of St Andrews. Retrieved 1 April 2014. O'Connor, J.J.; Robertson, E.F. (May 1996b). "A History of Quantum Mechanics". MacTutor History of Mathematics archive. University of St Andrews. Retrieved 1 April 2014. Oerter, R. (2006). The Theory of Almost Everything: The Standard Model, the Unsung Triumph of Modern Physics. Pi Press. ISBN 978-0-13-236678-6. Penrose, R.; Shimony, A.; Cartwright, N.; Hawking, S. (1997). The Large, the Small and the Human Mind. Cambridge University Press. ISBN 978-0-521-78572-3. Penrose, R. (2004). The Road to Reality. A.A. Knopf. ISBN 978-0-679-45443-4. Rosenberg, Alex (2006). Philosophy of Science. Routledge. ISBN 978-0-415-34317-6. Schrödinger, E. (1983). My View of the World. Ox Bow Press. ISBN 978-0-918024-30-5. Schrödinger, E. (1995). The Interpretation of Quantum Mechanics. Ox Bow Press. ISBN 978-1-881987-09-3. Singer, C. (2008). A Short History of Science to the 19th Century. Streeter Press. Smith, A. Mark (2001). Alhacen's Theory of Visual Perception: A Critical Edition, with English Translation and Commentary, of the First Three Books of Alhacen's De Aspectibus, the Medieval Latin Version of Ibn al-Haytham's Kitāb al-Manāẓir, 2 vols. Transactions of the American Philosophical Society. Vol. 91. Philadelphia: American Philosophical Society. ISBN 978-0-87169-914-5. OCLC 47168716. Smith, A. Mark (2001a). "Alhacen's Theory of Visual Perception: A Critical Edition, with English Translation and Commentary, of the First Three Books of Alhacen's "De aspectibus", the Medieval Latin Version of Ibn al-Haytham's "Kitāb al-Manāẓir": Volume One". Transactions of the American Philosophical Society. 91 (4): i–clxxxi, 1–337. doi:10.2307/3657358. JSTOR 3657358. Smith, A. Mark (2001b). "Alhacen's Theory of Visual Perception: A Critical Edition, with English Translation and Commentary, of the First Three Books of Alhacen's "De aspectibus", the Medieval Latin Version of Ibn al-Haytham's "Kitāb al-Manāẓir": Volume Two". Transactions of the American Philosophical Society. 91 (5): 339–819. doi:10.2307/3657357. JSTOR 3657357. Stajic, Jelena; Coontz, R.; Osborne, I. (8 April 2011). "Happy 100th, Superconductivity!". Science. 332 (6026): 189. Bibcode:2011Sci...332..189S. doi:10.1126/science.332.6026.189. PMID 21474747. Taylor, P.L.; Heinonen, O. (2002). A Quantum Approach to Condensed Matter Physics. Cambridge University Press. ISBN 978-0-521-77827-5. Thurston, H. (1994). Early Astronomy. Springer. Tipler, Paul; Llewellyn, Ralph (2003). Modern Physics. W. H. Freeman. ISBN 978-0-7167-4345-3. Toraldo Di Francia, G. (1976). The Investigation of the Physical World. CUP Archive. ISBN 978-0-521-29925-1. Walsh, K.M. (1 June 2012). "Plotting the Future for Computing in High-Energy and Nuclear Physics". Brookhaven National Laboratory. Archived from the original on 29 July 2016. Retrieved 18 October 2012. Young, H.D.; Freedman, R.A. (2014). Sears and Zemansky's University Physics with Modern Physics Technology Update (13th ed.). Pearson Education. ISBN 978-1-292-02063-1. Physics at Wikipedia's sister projects Definitions from WiktionaryMedia from CommonsNews from WikinewsQuotations from WikiquoteTexts from WikisourceTextbooks from WikibooksResources from Wikiversity Physics at Quanta Magazine Usenet Physics FAQ – FAQ compiled by sci.physics and other physics newsgroups Website of the Nobel Prize in physics – Award for outstanding contributions to the subject World of Physics – Online encyclopedic dictionary of physics Nature Physics – Academic journal Physics – Online magazine by the American Physical Society – Directory of physics related media The Vega Science Trust – Science videos, including physics HyperPhysics website – Physics and astronomy mind-map from Georgia State University Physics at MIT OpenCourseWare – Online course material from Massachusetts Institute of Technology The Feynman Lectures on Physics Retrieved from " You need to enable JavaScript to access Isaac Physics.