DOWNLOAD PDF FOR THE LOVE OF PHYSICS WALTER LEWIN

Chapter 1 : Los Angeles Times - We are currently unavailable in your region

In For the Love of Physics, beloved MIT professor Walter Lewin, whose riveting physics lectures made him a YouTube super-star, takes readers on a remarkably fun, inventive, and often wacky journey that brings the joys of physics to life.

I owe a lot to the Dutch educational system. I went to graduate school at the Delft University of Technology in the Netherlands, and killed three birds with one stone. Right from the start, I began teaching physics. To pay for school I had to take out a loan from the Dutch government, and if I taught full time, at least twenty hours a week, each year the government would forgive one-fifth of my loan. The military would have been the worst, an absolute disaster for me. So I taught math and physics full time, twenty-two contact hours per week, at the Libanon Lyceum in Rotterdam, to sixteen-and seventeen-year-olds. I avoided the army, did not have to pay back my loan, and was getting my PhD, all at the same time. I also learned to teach. For me, teaching high school students, being able to change the minds of young people in a positive way, that was thrilling. I always tried to make classes interesting but also fun for the students, even though the school itself was quite strict. The classroom doors had transom windows at the top, and one of the headmasters would sometimes climb up on a chair and spy on teachers through the transom. Can you believe it? My goal was to impart that enthusiasm to my students, to help them see the beauty of the world all around them in a new way, to change them so that they would see the world of physics as beautiful, and would understand that physics is everywhere, that it permeates our lives. What counts, I found, is not what you cover, but what you uncover. Covering subjects in a class can be a boring exercise, and students feel it. Uncovering the laws of physics and making them see through the equations, on the other hand, demonstrates the process of discovery, with all its newness and excitement, and students love being part of it. I got to do this also in a different way far outside the classroom. Every year the school sponsored a week-long vacation when a teacher would take the kids on a trip to a fairly remote and primitive campsite. My wife, Huibertha, and I did it once and loved it. We all cooked together and slept in tents. Then, since we were so far from city lights, we woke all the kids up in the middle of one night, gave them hot chocolate, and took them out to look at the stars. We identified constellations and planets and they got to see the Milky Way in its full glory. The truth is that just about every physicist who walks the Earth has a love for astronomy. Many physicists I know built their own telescopes when they were in high school. My longtime friend and MIT colleague George Clark ground and polished a 6-inch mirror for a telescope when he was in high school. Why do physicists love astronomy so much? For one thing, many advances in physicsâ€"theories of orbital motion, for instanceâ€"have resulted from astronomical questions, observations, and theories. But also, astronomy is physics, writ large across the night sky: Just look up in the sky and ask yourself some obvious questions: Why is the sky blue, why are sunsets red, why are clouds white? Physics has the answers! The light of the Sun is composed of all the colors of the rainbow. This is called Rayleigh scattering. Blue light scatters the most of all colors, about five times more than red light. Because the Moon has no atmosphere. Why are sunsets red? For exactly the same reason that the sky is blue. When the Sun is at the horizon, its rays have to travel through more atmosphere, and the green, blue, and violet light get scattered the mostâ€"filtered out of the light, basically. Why are clouds white? The water drops in clouds are much larger than the tiny particles that make our sky blue, and when light scatters off these much larger particles, all the colors in it scatter equally. This causes the light to stay white. But if a cloud is very thick with moisture, or if it is in the shadow of another cloud, then not much light will get through, and the cloud will turn dark. I turn all the lights off and aim a very bright spotlight of white light at the ceiling of the classroom near my blackboard. The spotlight is carefully shielded. Then I light a few cigarettes and hold them in the light beam. The smoke particles are small enough to produce Rayleigh scattering, and because blue light scatters the most, the students see blue smoke. I then carry this demonstration one step further. I inhale the smoke and keep it in my lungs for a minute or soâ€"this is not always easy, but science occasionally requires sacrifices. I then let go and exhale the smoke into the light beam. The students now see white smokeâ€"I have created a white cloud! The tiny smoke particles have grown in my lungs, as there is a lot of water vapor there. So now all the colors scatter equally, and the scattered light is white. The color change from blue light to white light is truly amazing! Why is the sky blue, and why are clouds white? Actually, there is also a third very interesting question, having to do with the polarization of light. Out in the country with my students I could show them the Andromeda galaxy, the only one you can see with the naked eye, around 2. Imagine thatâ€" billion stars, and we could just make it out as a faint fuzzy patch. We also spotted lots of meteoritesâ€"most people call them shooting stars. The more distant the satellite, and therefore the greater the difference in time between sunset on Earth and at the satellite, the later you can see it at night. The conditions are best only about two dozen evenings and mornings a year. How wonderful it is when you actually find it! Stargazing connects us to the vastness of the universe. If we keep staring up at the night sky, and let our eyes adjust long enough, we can see the superstructure of the farther reaches of our own Milky Way galaxy quite beautifullyâ€"some billion to billion stars, clustered as if woven into a diaphanous fabric, so delightfully delicate. The size of the universe is incomprehensible, but you can begin to grasp it by first considering the Milky Way. Our current estimate is that there may be as many galaxies in the universe as there are stars in our own galaxy. Or consider the recent discovery of the single largest structure in the known universe, the Great Wall of galaxies, mapped by the Sloan Digital Sky Survey, a major project that has combined the efforts of more than three hundred astronomers and engineers and twenty-five universities and research institutions. The dedicated Sloan telescope is observing every night; it went into operation in the year and will continue till at least the year The Great Wall is more than a billion light-years long. Is your head spinning? If not, then consider that the observable universe not the entire universe, just the part we can observe is roughly 90 billion light-years across. This is the power of physics; it can tell us that our observable universe is made up of some billion galaxies. It can also tell us that of all the matter in our visible universe, only about 4 percent is ordinary matter, of which stars and galaxies and you and I are made. The remaining 73 percent, which is the bulk of the energy in our universe, is called dark energy, which is also invisible. No one has a clue what that is either. Physics has explained so much, but we still have many mysteries to solve, which I find very inspiring. Physics explores unimaginable immensity, but at the same time it can dig down into the very smallest realms, to the very bits of matter such as neutrinos, as small as a tiny fraction of a proton. That is where I was spending most of my time in my early days in the field, in the realms of the very small, measuring and mapping the release of particles and radiation from radioactive nuclei. This was nuclear physics, but not the bomb-making variety. I was studying what made matter tick at a really basic level. You probably know that almost all the matter you can see and touch is made up of elements, such as hydrogen, oxygen, and carbon combined into molecules, and that the smallest unit of an element is an atom, made up of a nucleus and electrons. A nucleus, recall, consists of protons and neutrons. The lightest and most plentiful element in the universe, hydrogen, has one proton and one electron. But there is a form of hydrogen that has a neutron as well as a proton in its nucleus. All isotopes of a given element have the same number of protons, but a different number of neutrons, and elements have different numbers of isotopes. There are thirteen isotopes of oxygen, for instance, and thirty-six isotopes of gold. Now, many of these isotopes are stableâ€"that is, they can last more or less forever. Some of the elements they transform into are stable, and then the radioactive decay stops, but others are unstable, and then the decay continues until a stable state is reached. Of the three isotopes of hydrogen, only one, tritium, is radioactiveâ€"it decays into a stable isotope of helium. If we say that tritium has a half-life of about twelve years, we mean that in a given sample of tritium, half of the isotopes will decay in twelve years only one-quarter will remain after twenty-four years. Nuclear decay is one of the most important processes by which many different elements are transformed and created. In fact, during my PhD research, I was often watching radioactive gold isotopes decay into mercury rather than the other way around, as the medieval alchemists would have liked. There are, however, many isotopes of mercury, and also of platinum, that decay into gold. But only one platinum isotope and only one mercury isotope decay into stable gold, the kind you can wear on your finger. The work was immensely exciting; I would have radioactive isotopes literally decaying in my hands. And it was very intense. The isotopes I was working with typically had half-lives of only a day or a few days. Gold, for instance, has a half-life of a little over two and a half days, so I had to work fast. I would drive from Delft to Amsterdam, where they used a cyclotron to make these isotopes, and rush back to the lab at Delft. There I would dissolve the isotopes in an acid to get them into liquid form, put them on very thin film, and place them into detectors.

Chapter 2 : Walter Lewin - Wikipedia

On May 16, , Professor of Physics Emeritus Walter Lewin returned to MIT lecture hall for a physics talk and book signing, complete with some of hi.

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But if a cloud is very thick with moisture, or if it is in the shadow of another cloud, then not much light will get through, and the cloud will turn dark. One of the demonstrations I love to do is to create a patch of "blue sky" in my classes. I turn all the lights off and aim a very bright spotlight of white light at the ceiling of the classroom near my blackboard. The spotlight is carefully shielded. Then I light a few cigarettes and hold them in the light beam. The smoke particles are small enough to produce Rayleigh scattering, and because blue light scatters the most, the students see blue smoke. I then carry this demonstration one step further. I inhale the smoke and keep it in my lungs for a minute or so--this is not always easy, but science occasionally requires sacrifices. I then let go and exhale the smoke into the light beam. The students now see white smoke--I have created a white cloud! 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Chapter 3 : Walter Lewin of MIT Teaches Physics | Bill Gates

Walter Lewin was a professor of physics at the Massachusetts Institute of Technology (MIT) until his retirement in and was well known for his popular lectures on physics which appeared on the MIT OpenCourseWare website - that is until MIT indefinitely suspended access to Lewin's courses on OpenCourseWare in late "after its.

Explore Description For the Love of Physics attempts to make learning even the most difficult of Physics concepts fun, even for those who are not science geeks. His video tutorials on YouTube are hugely popular. In For the Love of Physics, he brings that informal and entertaining approach to teaching physics in text format. Beginning with the simple question of why the sky is blue, he explains the principle of scattering of light. He then goes on to other physics concepts that take the reader on a journey. As the first chapter aptly puts it, from the nucleus to deep space. With this book, the reader can actually begin to understand the rules that govern the world we live in. The author explains in a simple, engaging style, the laws of physics behind everything we see around us - electricity, magnetism, the laws of motion, gravity, measurements, and other interesting topics like rainbows and black holes. So, did anyone know that the statement that one is taller lying down than standing up is actually true? The author proves this by measuring a student standing up, and then lying down. He explains that gravity compresses the soft tissues between the vertebrae in our spines when standing. Lying down, the tissues expand, so the difference in length. Earlier, astronauts complained that their suits did not fit them in outer space. The reduced gravity made them taller. Peppered with a lot of such interesting facts, this book will persuade even the most reluctant of readers to tread the waters, and then plunge deep into the world of physics. Through this book, readers may emerge with a love for the subject or develop a new perspective to the world around them. His teaching style was always hands-on as he firmly believes that physics is fundamentally an experimental science. Another book by the author is Compact Stellar X-ray Sources. His dynamic and informal style of writing and teaching captures the attention of even people who do not have a science background. This style helps in understanding complex concepts in physics easily. He soon became an assistant professor. His passion for physics and his interest in communicating the beauty of physics to others made him stay at MIT as a professor, teaching core courses in physics. His lecture videos are quite popular, attracting a wide audience.

Chapter 4 : For the Love of Physics : Walter H. G. Lewin :

"For the Love of Physics captures Walter Lewin's extraordinary intellect, passion for physics and brilliance as a teacher. Hopefully, this book will bring even more people into the orbit of this extraordinary educator and scientist.".

Now his lectures are reaching millions of students around the world. In the Institute began videotaping the 94 lectures from the three courses, and in OpenCourseWare started posting the videos, which could be viewed free of charge by anyone with an Internet connection. Most often, people write to thank him for changing their view of physicsâ€”and the world. Lewin makes a point of answering every e-mail. He thanks his online students and volleys back meticulous explanations to physics questions, often within minutes of receiving them. He is quick to offer suggestions for supplementary materials, and once he even mailed 18 physics books in response to a plea from a boy who came from a poor family and was struggling with a hearing impairment. Some people hope to meet Lewin someday, and many make the trip to MIT hoping to encounter him in person. Once he accepted an invitation to visit an admirer in Seattle. I feel the sensation of acceleration, yet I know this simulator is not moving. One year-old girl from Chennai, India, reflected the sentiment of many in an e-mail to Lewin in In fact, he asserts that he can teach the trick to anyone in five minutes or less. Back in his office, he retrieves the chalk from his student. What if she never gets it? What if the chalk refuses to jump? But he presses on, encouraging her to try again. After nearly five minutes, the chalk jumps. The studentâ€”this writerâ€”must admit that the first jump was almost exhilarating, like a shot of espresso, or joy. The effort Lewin put into demonstrating and explaining was perhaps disproportionate to the triviality of the exercise, but for him, the payoffâ€—that electric moment of understandingâ€—is worth it. Lewin has applied the same energy and effort to teaching physics, aiming to instill a visceral, long-lasting understanding in his students. In his final 8. In , Germany seized control of the Netherlands and deported droves of Dutch citizens to concentration camps. In his book, he notes that his father, who was Jewish, faced increasing restrictions at the hands of the Nazisâ€—he was banned from public transportation, public parks, and even his favorite restaurants. The cemetery was one of the few places he was allowed to frequent. The school offered typewriting and shorthand, and when he was in college Lewin helped out as an instructor. It was art, however, that first triggered his love of teaching. He absorbed an early appreciation of art from his parents, who owned an extensive collection of paintings. One of his favorites was a portrait of his father that now hangs over his fireplace in Cambridge. Lewin remembers delivering his first lecture, to his high-school peers, when he was After graduation, Lewin received a pivotal invitation from Bruno Rossi, a pioneer of x-ray astronomy, to come to MIT and work in the emerging field. Once on campus, he joined a team of researchers analyzing data from weather balloons for x-ray sourcesâ€—evidence of far-off galaxies. Six months after he set foot on campus, MIT offered Lewin a faculty position, and as he likes to say, he never left. Lewin dove enthusiastically into x-ray astronomy at the Institute. At any given class, students found the professor balancing on a ladder as he sucked from a five-meter-long straw to demonstrate hydrostatic pressure; or rocketing across the stage on a tricycle powered by a fire extinguisher; or playfully thwacking a student with a pelt of cat fur to create an electric charge. These classes may have had an air of ease and improvisation, but Lewin took great pains in assembling each lecture. He made sure to lay a foundation and provide context, combining equations and demonstrations. Walter Lewin demonstrates that the period of a pendulum is independent of the mass hanging from the pendulum. To achieve this, Lewin typically spent 40 to 50 hours preparing for each lecture, rehearsing the minute production two or three timesâ€—the last on the morning of class. His lecture notes, which are preserved and proudly displayed in a series of binders on his office shelves, reveal an intense drive for both precision and drama. For example, Lewin marked his written notes at five-minute intervals and used a large clock onstage to make sure he was on track. He also made sketches of the light panel in the hall, coloring in which buttons to push at particular points throughout the lecture. This way, he says, not a second was lost to logistics. Sitting at a desk, Lewin would speak candidly into the camera, peppering his talk with sketches, demonstrations, and personal stories. And just like his live lectures, the sessions were timed to the second. Milanesi and videographer Tom White were among the crew that completed the task over the next few years. He works with Walter Lewin! I have literally hundreds of pages of diagrams and worked problems, all of which were catalyzed by those 8. Lewin smokes several cigarettes at a time to demonstrate Rayleigh scattering, the scattering of light by particles much smaller than the wavelength of the light. When he exhales smoke over an unpolarized light source, the extremely fine particles scatter the light, making the smoke appear blue. Donald Sadoway, a popular lecturer and professor of materials chemistry, credits him with helping to develop his own teaching style at a school that tends to give research, not teaching, top billing. For example, he often stops by fountains on a sunny day to point out rainbows to passers-by. In , he went to see Lewin at a campus Hillel event and introduced himself as a former student. Lewin asked whether Goldbeck carried a diffraction gratingâ€”a plastic slide that splits light into various wavelengths, making all the colors in a beam visible. The professor held it up to the light for a moment and reached into his pocket for his own. Beyond Although Lewin became emeritus and retired from teaching in , he still comes to his office on campus twice a week to open his mail, discuss research, read literature, and meet admirers who want to shake his hand. He receives regular requests to speak around the world and recently accepted invitations to lecture in South Korea, Washington, D. Lewin also accepts friend requests on Facebook, though not without making a request of his own. For years, he held a weekly art contest outside his MIT office, challenging students to guess who had created a certain work and when. Fewer than 50 people have passed the test. A recent visit to his office found Lewin in the midst of a move. His binders, containing the notes from every one of his videotaped lectures including some he did for children and one he gave at the University of Delft , had already been moved to the new space. On May 16, , Lewin celebrated the release of his book by taking his notes out once more to deliver one last lecture in The hall was filled beyond its capacity with current and former students, faculty, and fans. For Lewin, that last lectureâ€”of more than he has given in the hallâ€—was a bittersweet high. Then you know that it comes to an end. But the beauty is, two million people watch me every year. And that will only increase. Join us at EmTech Digital

Chapter 5 : The Professor Who Brings Physics to Life - MIT Technology Review

Do you have the Walter Lewin book For the Love of Physics? Why does "For the love of Physics" by Walter Lewin cost more in the Kindle/ebook edition than in paperback?

Chapter 6 : Walter Lewin (Author of For the Love of Physics)

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Chapter 7 : 'For the Love of Physics': Book review - latimes

For the Love of Physics From the End of the Rainbow to the Edge of Time â€” A Journey Through the Wonders of Physics Walter Lewin, with Warren Goldstein Free Press, pp., $26 For more than

Chapter 8 : For the Love of Physics (Audiobook) by Walter Lewin, Warren Goldstein | www.nxgvision.com

Walter Lewin bridges the chasm between the lay public and Physics by simplifying and vivifying fundamental laws of a confusing science. With erudition and demonstration Lewin reflects joy in physics. Lewin is a teacher and astrophysicist at the Massachusetts Institute of Technology.