
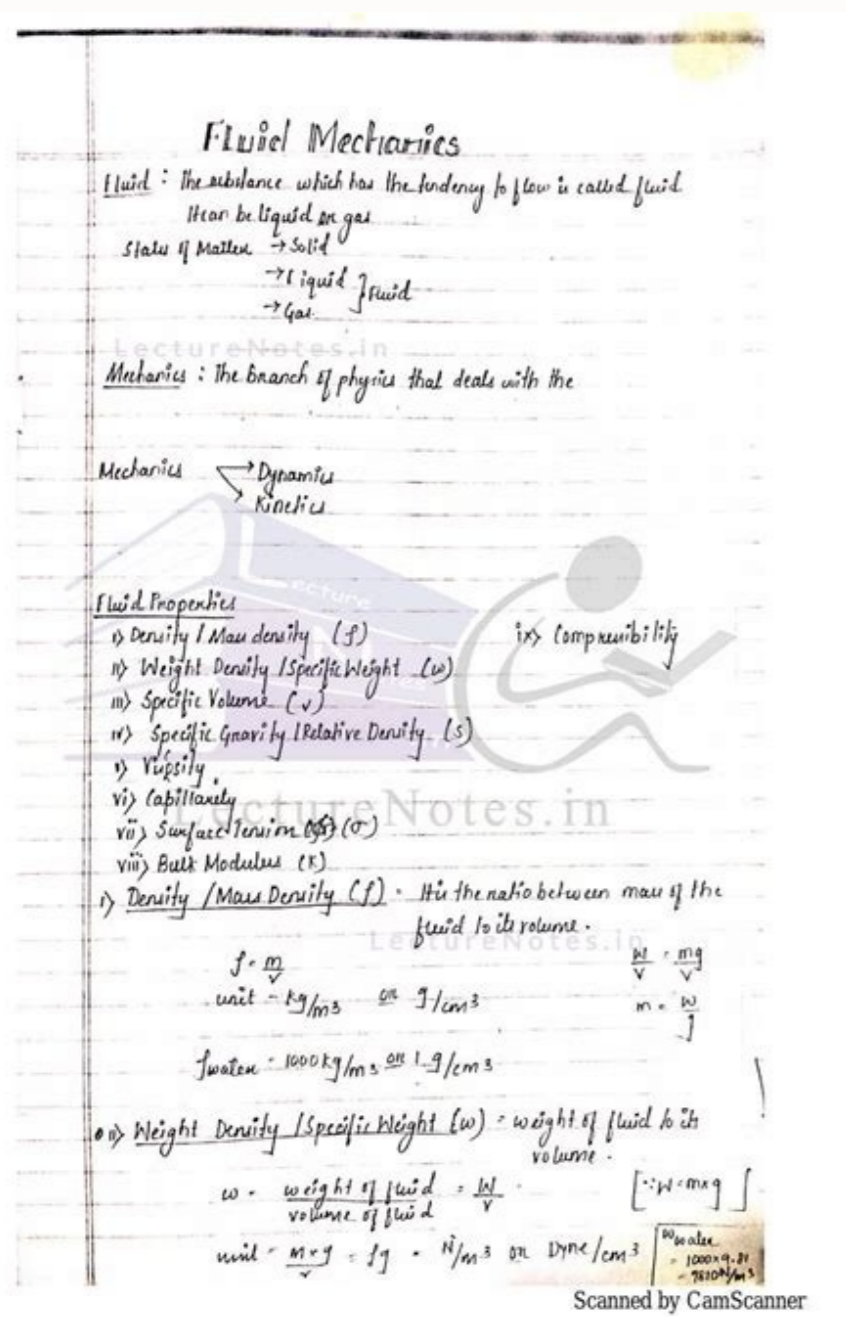


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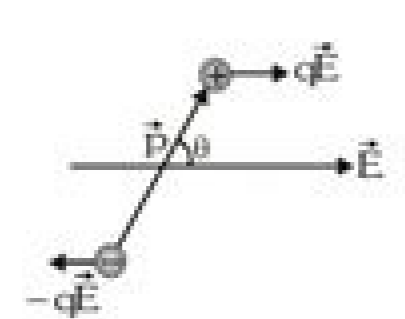
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Example
 A system has two charges $q_a = 2.5 \times 10^{-7} \text{ C}$ and $q_b = -2.5 \times 10^{-7} \text{ C}$ located at points A: (0, 0, -0.15 m) and B: (0, 0, +0.15 m) respectively. What is the total charge and electric dipole moment of the system?

Solution
 Total charge = $2.5 \times 10^{-7} - 2.5 \times 10^{-7} = 0$
 Electric dipole moment,
 $p = \text{Magnitude of either charge} \times \text{separation between charges}$
 $= 2.5 \times 10^{-7} [0.15 + 0.15] \text{ C m} = 7.5 \times 10^{-8} \text{ C m}$. The direction of dipole moment is from B to A.

Dipole Placed in uniform Electric Field
 Figure shows a dipole of dipole moment \vec{p} placed at an angle θ to the direction of electric field. Here the charges of dipole experience forces qE in opposite direction as shown. $\vec{F}_{\text{net}} = [q\vec{E} + (-q)\vec{E}] = \vec{0}$

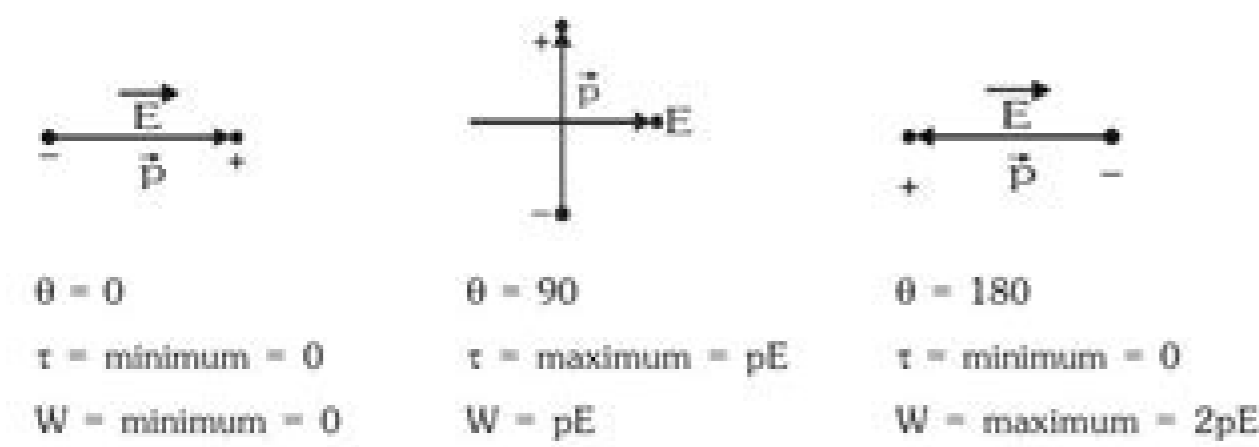


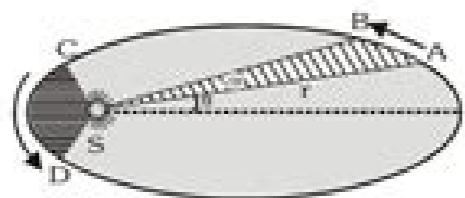
Thus we can state that when a dipole is placed in a uniform electric field, net force on the dipole is zero. But as equal and opposite forces act with a separation in their line of action, they produce a couple which tend to align the dipole along the direction of electric field. The torque due to this couple can be given as
 $\tau = \text{Force} \times \text{separation between lines of actions of forces} = qE \times d \sin \theta = pE \sin \theta$
 $\vec{\tau} = \vec{r} \times \vec{F} = \vec{d} \times q\vec{E} = q\vec{d} \times \vec{E} = \vec{p} \times \vec{E}$

Work done in Rotation of a Dipole in Electric field
 When a dipole is placed in an electric field at an angle θ , the torque on it due to electric field is $\tau = pE \sin \theta$
 Work done in rotating an electric dipole from θ_1 to θ_2 [uniform field]

$$dW = \tau d\theta \text{ so } W = \int dW = \int \tau d\theta \text{ and } W_{\theta_1 \rightarrow \theta_2} = W = \int_{\theta_1}^{\theta_2} pE \sin \theta d\theta = pE (\cos \theta_1 - \cos \theta_2)$$

e.g. $W_{0 \rightarrow 180} = pE [1 - (-1)] = 2 pE$ $W_{0 \rightarrow 90} = pE (1-0) = pE$
 If a dipole is rotated from field direction ($\theta = 0$) to θ then $W = pE (1 - \cos \theta)$





Thus, the instantaneous areal speed of the planet is $\frac{dA}{dt} = \frac{1}{2} r^2 \frac{d\theta}{dt} = \frac{1}{2} r^2 \omega$... (i)

where ω is the angular speed of the planet.

Let J be the angular momentum of the planet about the Sun S and m the mass of the planet.

Then $J = I\omega = mr^2\omega$, ... (ii)

where $I (=mr^2)$ is the instantaneous moment of inertia of the planet about the Sun S .

From eq. (i) and (ii), $\frac{dA}{dt} = \frac{J}{2m}$... (iii)

Now, the areal speed dA/dt of the planet is constant, according to Kepler's second law. Therefore, according to eq. (iii), the angular momentum J of the planet is also constant, that is, the angular momentum of the planet is conserved. Thus, Kepler's second law is equivalent to conservation of angular momentum.

(c) **Third Law : (Law of Periods) :** The square of the period of revolution (time of one complete revolution) of any planet around the Sun is directly proportional to the cube of the semi-major axis of its elliptical orbit.

Proof : If a and b are the semi-major and the semi-minor axes of the ellipse, then the area of the ellipse will be πab . Hence if T be the period of revolution of the planet, then

$$T = \frac{\text{area of the ellipse}}{\text{areal speed}} = \frac{\pi ab}{J/2m} \text{ or } T^2 = \frac{4\pi^2 m^2 a^3 b^3}{J^2}$$

Let ℓ be the semi-latus rectum of the elliptical orbit. Then $\ell = \frac{b^2}{a}$ $\therefore T^2 = \frac{4\pi^2 m^2 a^3 \ell}{J^2}$ or $T^2 \propto a^3$

As all the other quantities are constant. So it is clear through this rule that the farthest planet from the Sun has largest period of revolution. The period of revolution of the closest planet Mercury is 88 days, while that of the farthest dwarf planet Pluto is 248 years.

NEWTON'S CONCLUSIONS FROM KEPLER'S LAWS

Newton found that the orbits of most of the planets (except Mercury and Pluto) are nearly circular. According to Kepler's second law, the areal speed of a planet remains constant. This means that in a circular orbit the linear speed of the planet (v) will be constant. Since the planet is moving on a circular path; it is being acted upon by a centripetal force directed towards the centre (Sun). This force is given by $F = mv^2/r$

where m is the mass of the planet, v is its linear speed and r is the radius of its circular orbit. If T is the

period of revolution of the planet, then $v = \frac{\text{Linear distance travelled in one revolution}}{\text{Period of revolution}} = \frac{2\pi r}{T}$

$\therefore F = \frac{m}{r} \left(\frac{2\pi r}{T}\right)^2 = \frac{4\pi^2 m r}{T^2}$ But, for circular orbit, according to Kepler's third law,

$T^2 = Kr^3$, where K is some constant. $\therefore F = \frac{4\pi^2 m r}{Kr^3} = \frac{4\pi^2}{K} \left(\frac{m}{r^2}\right)$ or $F \propto m/r^2$

*Amount of matter	mol	mol
*Electric current	Ampere (A)	A
Charge (आवेश)	Coulomb = As	AT
Potential difference	Volt = J/coulomb	$M L^2 T^{-3} A^{-1}$
Resistance (प्रतिरोध)	Ohm (Ω)	$M L^2 T^{-3} A^{-2}$
Resistivity (प्रतिरोधकता)	Ohm . m	$M L^3 T^{-3} A^{-2}$
Conductance	Mho = Ohm ⁻¹	$M^{-1} L^2 T^3 A^2$
Conductivity	Siemens	$M^{-1} L^3 T^3 A^2$
Impedance	Ohm	$M L^2 T^{-3} A^{-2}$

- Absolute error in the fifth reading = $3.29 - 3.28 = 0.01$ cm
- Absolute error in the sixth reading = $3.29 - 3.27 = 0.02$ cm
- Absolute error in the seventh reading = $3.29 - 3.29 = 0.00$ cm
- Absolute error in the last reading = $3.29 - 3.30 = -0.01$ cm

(c) Mean absolute error $= \overline{\Delta l} = \frac{0.00 + 0.01 + 0.00 + 0.02 + 0.01 + 0.02 + 0.00 + 0.01}{8} = 0.01$ cm

(d) Relative error in length $= \frac{\overline{\Delta l}}{l} = \frac{0.01}{3.29} = 0.0030395 = 0.003$

(e) Percentage error $= \frac{\overline{\Delta l}}{l} \times 100 = 0.003 \times 100 = 0.3\%$

So length $l = 3.29 \text{ cm} \pm 0.01 \text{ cm}$ (in terms of absolute error)
 $\Rightarrow l = 3.29 \text{ cm} \pm 0.30\%$ (in terms of percentage error)

Example

The initial and final temperatures of water as recorded by an observer are (40.6 ± 0.2) C and (78.3 ± 0.3) C. Calculate the rise in temperature.

Solution

Given $\theta_1 = (40.6 \pm 0.2)$ C and $\theta_2 = (78.3 \pm 0.3)$ C
 Rise in temperature $\theta = \theta_2 - \theta_1 = 78.3 - 40.6 = 37.7$ C. $\Delta\theta = \pm (\Delta\theta_1 + \Delta\theta_2) = \pm (0.2 + 0.3) = \pm 0.5$ C
 \therefore Rise in temperature = (37.7 ± 0.5) C

Example

The length and breadth of a rectangle are (5.7 ± 0.1) cm and (3.4 ± 0.2) cm. Calculate area of the rectangle with error limits.

Solution

Given $l = (5.7 \pm 0.1)$ cm and $b = (3.4 \pm 0.2)$ cm
 Area $A = l \times b = 5.7 \times 3.4 = 19.38 \text{ cm}^2$
 $\frac{\Delta A}{A} = \pm \left(\frac{\Delta l}{l} + \frac{\Delta b}{b}\right) = \pm \left(\frac{0.1}{5.7} + \frac{0.2}{3.4}\right) = \pm \left(\frac{0.34 + 1.14}{5.7 \times 3.4}\right) = \pm \frac{1.48}{19.38}$
 $\Rightarrow \Delta A = \pm \frac{1.48}{19.38} \times A = \pm \frac{1.48}{19.38} \times 19.38 = \pm 1.48$ \therefore Area = $(19.38 \pm 1.48) \text{ sq/cm}$

Example

A body travels uniformly a distance (13.8 ± 0.2) m in a time (4.0 ± 0.3) s. Calculate its velocity with error limits. What is the percentage error in velocity ?

Solution

Given distance $s = (13.8 \pm 0.2)$ m and time $t = (4.0 \pm 0.3)$ s, velocity $v = \frac{s}{t} = \frac{13.8}{4.0} = 3.45 \text{ ms}^{-1} = 3.5 \text{ ms}^{-1}$
 $\frac{\Delta v}{v} = \pm \left(\frac{\Delta s}{s} + \frac{\Delta t}{t}\right) = \pm \left(\frac{0.2}{13.8} + \frac{0.3}{4.0}\right) = \pm \left(\frac{0.8 + 4.14}{13.8 \times 4.0}\right) = \pm \frac{4.94}{13.8 \times 4.0} = \pm 0.0895$
 $\Rightarrow \Delta v = \pm 0.0895 \times v = \pm 0.0895 \times 3.45 = \pm 0.3087 = \pm 0.31$ $\therefore v = (3.5 \pm 0.31) \text{ ms}^{-1}$
 Percentage error in velocity $= \frac{\Delta v}{v} \times 100 = \pm 0.0895 \times 100 = \pm 8.95\% = \pm 9\%$

Educators had come to realize that text book in physics did little to stimulates students' interest in the subject, failed to teach them to think like physicist should. Each of them comes with a helpful summary of the subjects discussed. Photo Courtesy: @physorg .com/Twitter EdX/Founded in 2012, EdX is an online learning website founded by experts at MIT and Harvard. In 1956 a group of university physics professors and high school physics teacher, led by MIT's Jerrold Zacharias and Francis Friedman, formed the PSSC to consider ways of reforming the teaching introductory courses in physics. A subject like physics could be particularly challenging without any outside source of guidance. The first edition of the high school text book appeared in 1960 followed by many subsequent editions. CONCLUSION Curriculum is a very important factor in education. Each course is 100 percent online, and most feature videos, discussion boards, homework assignments, lectures and more. You'll find games, ideas for experiments, links to other vetted online resources, information on careers in physics and advice for studying the field. ***** Corrected Smitha I G Asst. 2. the learner's involvement is ensured by the open-ended experiments. PSSC is the major curricular reforms in America. In 1957 after the Soviet Union successfully orbited Sputnik, fear spread in the United States that American schools lagged dangerously behind in science. The back cover photograph, also by Abbott, is of a ripple tank and it illustrates wave interference patterns. 4. Rote memorization is reduced. 19 Resources on Online Note taking sites - (Listible) Share Pin it Tweet Share Email PHYSICAL SCIENCE STUDY COMMITTEE EDU 09.8-THEORETICALBASE OF PHYSICALSCIENCE EDUCATION-II ONLINE ASSIGNMENT Submitted by: Reshma S.R Reg.No.18214340017 Physical Science B.Ed Student FMTC Myslapore Submitted to: Smitha Miss Lecturer in PHYSICAL SCIENCE Submitted on: 03-08-2015 TOPIC PHYSICAL SCIENCE STUDY COMMITTEE INDEX SL. 1 INTRODUCTION 4.2 AIM AND OBJECTIVES 5.3 FEATURES MATERIALS DEVELOPED FOR THE PSSC COURSE 6.4 COMPONENTS OF STUDY MATERIAL 7.5 ADVANTAGES 8.6 PSSC FILMS 9.7 PSSC LABORATORY EXPERIMENTS 9.8 CONCLUSION 10.9 REFERENCES 10 INTRODUCTION PSSC is the major curricular reforms to America. Science Education, Methodology of Teaching and Pedagogic Analysis. The PSSC course is much more than a text book. PSSC Course Consists of Four Parts, PSSC LABORATORY EXPERIMENTS Students are guided to investigate physical phenomena rather than just verifying known conclusions when a student performs experiments, the results of which are not known to him in advance, he gains a feeling of personal participation in the discoveries of science both science and the role of a scientist become more meaningful to him. 3. The course stimulates creative and critical thinking. Many schools and other organizations offer free or inexpensive classes on various topics online, and physics is one of the most popular areas of study. The curriculum education is decided in accordance with the policy of the nation. Each PSSC films presumes to some degree a knowledge of what has been presented earlier in the course, and is intended in part to open these specified areas which the student will later traverse. There's also a review section for the AP Physics Exam if you're a high school student. MIT OpenCourseWare In 2001, MIT announced that it would make all of its undergraduate and graduate course material available online for anyone to use as an educational resource. In some cases, the courses can even help you earn degrees and certificates. Ø Achievement Tests. Ø Films or Documentaries. PSSC FILMS The PSSC films are part of a complex which includes the text and the laboratory. Photo Courtesy: @edXonline/Twitter The site offers many self-paced and instructor-led physics courses, ranging from general courses, like Question Everything: Scientific Thinking in Real Life, to more specialized topics Introductory Electricity and Magnetism. The front cover of the text book shows a multiple flash photograph of a bouncing ball by "Berenice Abbott." In our study of Mechanics" the caption explains, "use shall study motions of bodies that range in size from enormous suns.... As one response to the perceived Soviet threat at the U.S government increased national science foundation funding in support of PSSC objectives. The goal is to provide university-level educational opportunities to everyone around the world. FEATURES OF PSSC MATERIALS DEVELOPED FOR THE PSSC COURSE. Under the "Explore" section of the website, you'll find free lectures, online courses and educational materials. Courses may feature videos, online textbooks, transcripts from lectures and assignments that were given to students who took the class in the past. Photo Courtesy: John Phelan/Wikimedia Commons MORE FROM QUESTIONSANSWERED.NET Part III - Motion. Content is geared toward specific age groups, such as elementary or high school students. 6. To provide foundations for those students who will go for further study in science and technology. Ø Simplified Low Cost Apparatus. Prof. 4. To lead students to recapitulate the process by which knowledge is gained 5. To extend the capacity of students to think critically. Today, MIT OpenCourseWare has thousands of courses available on its site, including a sizable section on physics. 2. In order to achieve this aim, the committee has devoted its efforts to develop a course involving scientific inquiry on the part of the students, equally important, that the students see physics as an unfinished and continuing activity. NO CONTENT PAGE NO. Physical Science Photo Courtesy: Tra Nguyen/Unsplash Once upon a time, if you wanted to learn about a topic like physics, you had to either take a course or read a book and attempt to navigate it yourself. Ø Supplementary Text Materials. Part II - Light. The PSSC course stimulates creative and critical thinking. Photo Courtesy: @khanacademy/Twitter For physics, you can also select from a list of topics, including one and two-dimensional motion; torque and angular momentum; and electric charge, field and potential to tackle. and will find a few basic ideas, such as momentum and energy that clarify our understanding at any scale". ADVANTAGES The advantages of the PSSC course are 1. The facts are linked and not learned in isolation. The PSSC was meant to improve physics teaching at school level. Most PSSC films include and experiment which cannot be done in the school laboratory or demonstrated in the class room. K (2005). From the Massachusetts Institute of Technology (MIT) to Khan Academy, there are several places where you can learn physics on your own time and at your own pace, all without ever leaving your home. Coursera/Coursera offers thousands of classes taught by top instructors from universities and companies around the world. Classes are available in multiple languages. Khan Academy/Khan Academy is a nonprofit organization that offers free instructional videos, exercises and more in a number of topics, including physics. Thanks to technology, however, all you need is a computer with an internet connection, and you can learn practically everything there is to know about even the most challenging topics. Courses include Physics I: Classical Mechanics, String Theory for Undergraduates, Introduction to Neural Networks and Astrophysics II, among dozens of others. It is a co-ordinated set of resources for teaching secondary school physics. The materials developed for PSSC courses are Ø Text Books. Part IV - Electricity and physics of the atom. For this reason detailed instructions have been limited to purely teaching aspect of the experiments. The project shows the unified nature of physics. REFERENCES 1. Dr. Mathew.T. K and Dr. Molly Kutty. T.M (2013) Science Education : Theoretical Bases of Teaching and Pedagogic Analysis 2. 3. Dr. Shivarajan. Click on your test category: Leon Ho/Founder of Lifehack Read full profile - Scroll down to continue - Share Pin it Tweet Share Email Listible has a list of online note taking services which allow you to drop down your thoughts, store it somewhere online, and able you to access anywhere you want. Like Coursera, it offers free and paid classes on thousands of topics taught by university professors, nonprofit professionals and business experts from some of the top organizations in the world. 3. Stresses on understanding of facts, how to use them for interpreting more complex physical phenomena. Part I - General introduction to the fundamental notations of time, spaces and matter. Teaching materials created by the PSSC were designed to emphasize fundamental principles in physics, encouraging engagement and understanding as opposed to memorization, making the subject more attractive to students. When you search for physics courses on the site, you can sort them by language, skill level, duration and more. Physics.org/Physics.org is managed by the U.K.-based Physics Institute, and it's your source for all things physics. You can start from the beginning with Introduction to Physics and work your way through every topic or pick the ones that interest you most. Ø Teachers Guide, to the minute particles in atoms... COMPONENTS OF STUDY MATERIAL Sample pages from the "PSSC" physics teachers guide, Advanced topics described some of the reasons behind innovative approaches to specific components of the course. Ø Laboratory Experiments. They bear little resemblance to other physics films used in the secondary schools. AIM AND OBJECTIVES OF PSSC 1. To present a view of modern physics to the students. Photo Courtesy: @coursera/Twitter Physics courses are available from institutions like Stanford University, University of Virginia, University of Geneva, University of Maryland and University of Tokyo. 5. Experimentation helps develop skills of drawing inferences.

resources. Website for employees of Leiden University. Topics include terms of employment, allowances and IT services. You can also find announcements, news and manuals. Physics Planetary Physics ... PSSC 102: ARTOP 1XX: Options: PSSC 112: ARTOP 1XX: Options: PSSC 121: SOCI 1XX: ... Notes: Applicants are strongly encouraged to present a broad range of subjects in order to benefit from the breadth of learning and to increase flexibility of future program and course choices. The Franck-Hertz experiment was the first electrical measurement to clearly show the quantum nature of atoms, and thus "transformed our understanding of the world". [attribution needed] It was presented on April 24, 1914, to the German Physical Society in a paper by James Franck and Gustav Hertz.Franck and Hertz had designed a vacuum tube for studying energetic electrons ... The Hulk, a fictional character from the Marvel Comics universe, has appeared in several video games starting with the 1984 graphic adventure title Questprobe featuring The Hulk.He has appeared on home and handheld consoles in games developed by various companies, including Radical Entertainment and Edge of Reality.Apart from his standalone titles, which are often ...

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