

bubble gum physics

bubble gum physics explores the fascinating scientific principles behind the behavior of bubble gum, particularly when it is stretched, inflated, and manipulated. This field combines elements of materials science, fluid dynamics, and elasticity to explain how bubble gum can transform from a solid chewable substance into a thin, flexible film capable of forming bubbles. Understanding bubble gum physics involves studying the composition of gum, the molecular structure of its polymers, and the forces that govern bubble formation and stability. This article delves into the mechanics of bubble blowing, the role of surface tension, viscoelastic properties of gum, and the factors influencing bubble size and durability. Additionally, it examines the impact of environmental conditions and chewing techniques on bubble gum performance. By investigating these aspects, the article provides a comprehensive overview of the physics underlying bubble gum's unique characteristics. The following sections will outline the core concepts and scientific phenomena integral to bubble gum physics.

- The Composition and Structure of Bubble Gum
- Elasticity and Viscoelastic Properties
- The Mechanics of Bubble Formation
- Surface Tension and Bubble Stability
- Environmental and Chewing Factors Affecting Bubble Gum

The Composition and Structure of Bubble Gum

Bubble gum is a complex material primarily composed of gum base, sweeteners, softeners, flavorings, and coloring agents. The gum base is the key ingredient responsible for the elastic and stretchable nature of bubble gum, enabling its unique physical behavior. It consists of a mixture of natural and synthetic polymers, resins, waxes, and elastomers, which create a viscoelastic matrix. This matrix allows bubble gum to behave as both a solid and a fluid under different conditions, critical for bubble formation and expansion.

Polymer Network in Gum Base

The polymer network within the gum base is composed of long-chain molecules that are cross-linked to varying degrees. These polymers can stretch and slide past one another, giving the gum its flexibility and chewiness. The degree of polymerization and cross-linking affects the gum's mechanical properties, such as tensile strength and extensibility. These properties dictate how the gum will respond when stretched during bubble blowing.

Role of Additives

Additives such as softeners and plasticizers are incorporated to modify the gum's texture and pliability. Softeners reduce the rigidity of the gum base, making it easier to chew and stretch. Sweeteners and flavorings enhance the sensory experience but do not significantly impact the physical properties relevant to bubble gum physics. Understanding the composition allows for tailoring gum formulations to optimize bubble blowing performance.

Elasticity and Viscoelastic Properties

Bubble gum exhibits viscoelastic behavior, meaning it has both elastic and viscous characteristics. Elasticity allows the gum to return to its original shape after deformation, while viscosity accounts for the time-dependent flow under stress. These properties are essential to comprehend the deformation and recovery processes during chewing and bubble formation.

Stress-Strain Relationship

When bubble gum is stretched, it experiences stress and strain. The stress-strain curve for bubble gum typically shows an initial elastic region where deformation is reversible, followed by a viscoelastic region where the gum undergoes plastic deformation. This behavior explains why bubble gum can be stretched extensively without breaking immediately, allowing the formation of thin films necessary for bubbles.

Time-Dependent Deformation

The viscous component causes bubble gum to exhibit creep and stress relaxation. Creep refers to the gradual elongation under a constant load, while stress relaxation is the decrease in stress under constant strain. These phenomena influence how the gum film thins and stabilizes during bubble inflation.

The Mechanics of Bubble Formation

The process of blowing a bubble involves inflating a thin film of bubble gum by introducing air into a small pocket formed in the gum. The mechanics behind this process are governed by the interplay of internal pressure, material elasticity, and surface forces.

Initiation of the Bubble

The initial step in bubble formation is creating a small pocket or cavity in the gum by stretching it with the tongue or fingers. This pocket acts as a nucleus for the bubble. Applying controlled pressure inflates the pocket, thinning the gum film as it expands outward.

Expansion Dynamics

As air is blown into the bubble, the film stretches further, increasing its surface area and decreasing its thickness. The elasticity of the gum resists expansion, creating an opposing force to the internal air pressure. The balance between these forces determines the maximum bubble size before rupture.

Failure and Rupture

Bubble rupture occurs when the tensile stress in the gum film exceeds its mechanical strength. Factors such as film thickness, presence of defects, and rate of expansion influence the likelihood of rupture. Understanding these mechanics aids in designing gums capable of producing larger and more durable bubbles.

Surface Tension and Bubble Stability

Surface tension plays a crucial role in bubble gum physics by influencing the shape and stability of the bubble. Although bubble gum is not a liquid, its thin films behave similarly to soap films in terms of surface energy considerations.

Surface Energy of Gum Films

The gum film's surface energy arises from molecular interactions at the air-gum interface. Minimizing this energy leads to the spherical shape of bubbles, which has the smallest surface area for a given volume. The balance between surface tension and internal pressure stabilizes the bubble temporarily.

Role in Bubble Longevity

High surface tension tends to contract the bubble, which can cause it to pop prematurely. The viscoelastic nature of the gum counteracts this effect by providing mechanical strength to the film. Additives in the gum can modify surface energy properties to enhance bubble stability.

Environmental and Chewing Factors Affecting Bubble Gum

External conditions and individual chewing behavior significantly impact the physics of bubble gum, influencing bubble size, stability, and overall performance.

Temperature Effects

Temperature alters the viscosity and elasticity of bubble gum. Higher

temperatures typically soften the gum, making it more pliable and easier to stretch, but can also weaken the film strength. Conversely, cold temperatures increase stiffness, reducing bubble size and durability.

Humidity and Moisture

Ambient humidity affects the moisture content of the gum and its surface properties. Excess moisture can reduce gum stickiness and alter viscoelastic properties, whereas dry conditions may cause the gum to become brittle and prone to cracking.

Chewing Techniques

The manner in which gum is chewed affects its temperature, hydration, and polymer network alignment. Vigorous chewing increases temperature and softens the gum, while prolonged chewing can degrade polymers, reducing bubble-blowing capability. Proper technique optimizes bubble formation by balancing these factors.

- Temperature control for optimal gum pliability
- Maintaining adequate hydration of the gum
- Chewing rhythm to enhance polymer alignment and elasticity
- Avoiding overstretching to prevent premature rupture

Frequently Asked Questions

What causes a bubble gum bubble to form?

A bubble gum bubble forms when air is blown into a stretched film of gum, creating a thin elastic membrane that expands due to the gum's viscoelastic properties.

Why does bubble gum stretch instead of breaking immediately?

Bubble gum stretches instead of breaking immediately because it is a viscoelastic material, meaning it has both viscous and elastic characteristics that allow it to deform under stress and recover without snapping.

How does temperature affect bubble gum physics?

Temperature affects bubble gum by altering its elasticity and viscosity; warmer temperatures make the gum softer and more stretchable, while colder temperatures make it stiffer and more prone to breaking.

What role does the gum's composition play in bubble formation?

The gum's composition, including polymers, plasticizers, and sugars, determines its elasticity and surface tension, which are crucial for forming stable bubbles that can expand without popping quickly.

Why do some bubble gum bubbles pop sooner than others?

Bubbles pop sooner due to factors like thin film thickness, air pressure inside the bubble, environmental humidity, and the gum's viscoelastic properties, which affect the membrane's stability.

Can bubble gum bubbles be made larger by blowing harder?

Blowing harder can initially make bubbles larger by increasing air pressure, but excessive force can cause the gum film to thin too much and pop sooner, limiting the maximum bubble size.

How does humidity influence the behavior of bubble gum bubbles?

High humidity can make the gum surface stickier and more pliable, potentially allowing bubbles to last longer, while low humidity can dry out the gum, making it brittle and more likely to pop.

What is the scientific explanation for the popping sound of bubble gum bubbles?

The popping sound occurs when the stretched gum membrane rapidly ruptures, causing a sudden release of trapped air and vibrations in the gum and surrounding air, producing a sharp noise.

Are there any mathematical models used to describe bubble gum bubble formation?

Yes, mathematical models involving fluid dynamics and membrane elasticity are used to describe bubble gum bubble formation, often adapting principles from thin film physics and viscoelastic material behavior to predict bubble

stability and growth.

Additional Resources

1. *The Science of Bubble Gum: Understanding Elasticity and Surface Tension*

This book explores the fundamental physics behind bubble gum, focusing on the material's elasticity and surface tension. It delves into how polymers in gum stretch and form bubbles, explaining the forces at play when a bubble inflates and pops. Readers will gain a clear understanding of the mechanical properties that make bubble gum so unique.

2. *Bubble Gum Dynamics: The Physics of Stretching and Bursting*

An in-depth look at the dynamics involved in bubble gum blowing, this book covers the processes of bubble formation, growth, and rupture. It uses mathematical models and experimental data to explain why bubbles pop and how different variables affect their size and durability. The content is suitable for both students and enthusiasts of soft matter physics.

3. *Chew and Stretch: The Material Science Behind Bubble Gum*

This title focuses on the material science aspects of bubble gum, discussing the composition and molecular structure of gum base. It explains how the combination of polymers, plasticizers, and fillers creates the chewable, stretchable texture. The book also examines how temperature and chewing affect gum properties.

4. *Bubble Gum Physics for Kids: Fun Experiments and Explanations*

Designed for younger readers, this book introduces basic physics concepts through interactive bubble gum experiments. It explains elasticity, surface tension, and air pressure in simple terms with colorful illustrations and step-by-step activities. Kids can learn the science behind their favorite chewy treat while having fun.

5. *The Mechanics of Bubble Formation in Chewing Gum*

This academic text investigates the mechanical processes involved in the nucleation and growth of bubbles within gum. It presents detailed studies using high-speed cameras and stress analysis tools to observe bubble behavior under various conditions. The book is a valuable resource for researchers in soft matter physics and polymer science.

6. *Bubble Gum and Soft Matter: A Physicist's Perspective*

An exploration of bubble gum within the broader context of soft matter physics, this book discusses viscoelasticity, non-Newtonian fluids, and polymer networks. It connects the everyday experience of chewing gum to advanced concepts in condensed matter physics, making complex theories accessible through relatable examples.

7. *From Chew to Pop: The Thermodynamics of Bubble Gum Bubbles*

This book studies the thermodynamic principles governing bubble gum bubbles, including heat transfer, pressure changes, and energy transformations. It explains how temperature influences bubble stability and elasticity, offering

insights into why some gums blow better bubbles in different climates.

8. *Bubble Gum Rheology: Flow and Deformation in Edible Polymers*

Focusing on rheology, this title examines how bubble gum flows and deforms under stress. It covers shear thinning, viscoelastic behavior, and time-dependent deformation, linking these properties to the sensation of chewing and bubble blowing. The book is ideal for food scientists and physicists interested in edible materials.

9. *The Art and Physics of Bubble Gum Blowing*

Combining scientific analysis with cultural history, this book looks at the art of bubble gum blowing alongside the physics that makes it possible. It includes profiles of famous bubble gum brands, interviews with bubble blowing champions, and explanations of the physical principles behind impressive bubble techniques. This engaging read appeals to both science lovers and pop culture fans.

Bubble Gum Physics

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Bubble Gum Physics: Unlocking the Science of Everyday Wonders

Ever wondered why bubbles pop? Or how a bouncy ball bounces? You're surrounded by physics every day, often without realizing it - and it's far more fascinating than you might think! Are you struggling to understand the seemingly complex world of physics? Do textbooks leave you feeling overwhelmed and confused? Do you wish science was more engaging and relatable to everyday life?

This book, *Bubble Gum Physics: Exploring the Science of Everyday Phenomena*, uses the familiar, fun world of bubble gum, bouncy balls, and other everyday objects to demystify fundamental physics concepts. It bridges the gap between complex scientific theories and real-world experiences, making learning accessible and enjoyable for everyone.

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Bubble Gum Physics: Exploring the Science of Everyday Phenomena (Article)

Introduction: The Physics of Fun - Why Everyday Objects are Amazing

Physics often gets a bad rap. It's seen as a dry, complicated subject reserved for geniuses with white lab coats. But physics is, quite simply, the study of how the universe works. And it's all around us, even in the seemingly trivial objects we interact with daily. This book uses these everyday objects—like bubble gum—to show you the beautiful physics hidden within. We'll explore fundamental principles like surface tension, elasticity, and aerodynamics, demonstrating how they govern the behavior of familiar objects. By the end, you'll appreciate the fascinating science behind your everyday experiences.

Chapter 1: The Amazing World of Bubbles - Surface Tension and Pressure

Bubbles, those ephemeral spheres of soapy water, are perfect examples of the interplay between surface tension and air pressure. Surface tension is the force that causes the surface of a liquid to contract and behave like a stretched elastic membrane. This is why water droplets form spherical shapes - it's the most efficient way to minimize surface area. In a bubble, the surface tension creates a thin film, holding the air inside. The pressure inside the bubble is slightly higher than the pressure outside, preventing it from collapsing. The size of the bubble depends on the balance between these two forces. We'll delve into the role of surfactants (like soap) in reducing surface tension, allowing for larger, more stable bubbles. Consider factors such as the type of soap used, the temperature of the water, and even the humidity of the air—all influencing bubble size and longevity. We'll even explore the physics behind why bubbles pop!

Chapter 2: The Science of Bouncy Balls - Elasticity and Collisions

Bouncy balls are a testament to elasticity—the ability of a material to return to its original shape after being deformed. When you drop a bouncy ball, it deforms upon impact, storing energy. This stored energy is then released, propelling the ball back upwards. The height to which it bounces depends on the ball's elasticity and the energy lost during the collision (primarily as heat and sound). Different materials exhibit different elastic properties. We'll explore the physics of elastic and inelastic collisions, examining how factors like the material's composition, temperature, and even the surface it bounces on affect the bounce height. This chapter will also touch upon the conservation of energy and momentum during a collision.

Chapter 3: Sticky Situations: The Physics of Adhesives and Viscosity

Bubble gum's stickiness is all about adhesion – the attraction between different surfaces. The molecules in the gum interact with the molecules on the surface it sticks to, creating a bond. Viscosity, the measure of a fluid's resistance to flow, also plays a significant role. The viscosity of the gum determines how easily it can spread and how strong its adhesive properties are. This chapter will delve into the chemistry and physics of adhesives, explaining why some substances are stickier than others. We'll consider the role of polymers in the stickiness of bubble gum, and how temperature affects the viscosity and adhesion.

Chapter 4: Spinning Tops and Gyroscopes - Angular Momentum and Stability

Spinning tops and gyroscopes demonstrate the concept of angular momentum – the rotational equivalent of linear momentum. The faster the top spins, the greater its angular momentum and the more stable it is. This stability arises from the conservation of angular momentum: any external torque that tries to tilt the top is resisted by the gyroscopic effect. We'll explore the principles of torque, precession, and nutation, showing how they govern the motion of spinning objects. We can even relate this to the stability of bicycles and even planets!

Chapter 5: The Flight of a Paper Airplane - Aerodynamics and Air Resistance

The flight of a paper airplane is a perfect illustration of aerodynamics – the study of how air interacts with moving objects. The shape of the airplane's wings creates lift, enabling it to stay aloft. Air resistance, or drag, opposes the airplane's motion, affecting its speed and range. This chapter

examines the principles of lift and drag, exploring how factors such as the airplane's design, the angle of attack, and airspeed influence its flight path. We'll explore how manipulating these factors can optimize the airplane's performance.

Chapter 6: Building a Better Bubble Blower - Engineering Principles

Designing a bubble blower involves applying several engineering principles. The size and shape of the blower affect the size and stability of the bubbles. The material used must be durable enough to withstand repeated use. This chapter will discuss the engineering design process, encouraging readers to apply the principles of physics and engineering to design their own optimal bubble blowers. It's a fun, hands-on application of what's been learned throughout the book.

Conclusion: The Ubiquitous Nature of Physics - Seeing the World Anew

By exploring the seemingly simple physics of everyday objects like bubble gum and bouncy balls, we've uncovered the fundamental principles governing the universe around us. Physics isn't just confined to laboratories; it's woven into the fabric of our daily lives. Understanding these principles allows us to appreciate the world in a new light, fostering curiosity and inspiring further exploration of the amazing science behind the seemingly ordinary.

FAQs:

1. What age group is this book suitable for? This book is suitable for middle school students and up, as well as adults interested in learning physics in a fun and engaging way.
2. Does the book require prior knowledge of physics? No, the book is written for readers with little to no prior knowledge of physics.
3. Are there any experiments or activities included? While not explicitly detailed experiments, the book encourages hands-on exploration and encourages readers to experiment with the concepts discussed.
4. What makes this book different from other physics textbooks? This book uses engaging examples from everyday life to make physics relatable and understandable.
5. What are the key takeaways from the book? Readers will gain a fundamental understanding of key physics concepts and how they apply to the world around them.
6. Is this book suitable for homeschooling? Absolutely! It's a great supplemental resource for homeschooling science curriculum.
7. Can I use this book for a science fair project? Absolutely! Many of the concepts discussed can be used as inspiration for a science fair project.
8. What are the different types of physics covered in this book? The book covers aspects of classical

mechanics, fluid dynamics, and thermodynamics.

9. Are there any mathematical equations in the book? The book minimizes complex mathematical equations and focuses on conceptual understanding.

Related Articles:

1. **The Science of Bubbles: A Deep Dive into Surface Tension:** Explores surface tension in detail, including different types of liquids and their surface tension properties.
2. **Elasticity and Collisions: The Physics of Bouncy Balls:** Focuses on the specific properties of different bouncy ball materials and their impact on bounce height.
3. **Adhesives and Viscosity: Exploring the Stickiness of Bubble Gum:** A detailed look at the chemical composition and physical properties that make bubble gum sticky.
4. **Angular Momentum and Gyroscopic Effects: Understanding Spinning Tops:** A comprehensive analysis of angular momentum and its effects on spinning objects.
5. **Aerodynamics and Flight: The Physics of Paper Airplanes:** Covers the principles of aerodynamics and how they apply to paper airplane design.
6. **The Physics of Balloons: Pressure, Buoyancy, and Elasticity:** Explores the physics behind inflated balloons, buoyancy, and how they relate to air pressure.
7. **The Science of Slime: Polymers, Viscosity, and Non-Newtonian Fluids:** Explores the properties of slime and other non-Newtonian fluids.
8. **The Physics of Water: Surface Tension, Cohesion, and Adhesion:** A detailed look at the fascinating properties of water.
9. **Simple Machines and Everyday Physics: Levers, Pulleys, and Inclined Planes:** Shows how simple machines demonstrate fundamental physical principles.

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BEING. I have Bubble Gum Brain. I like to chew on my thoughts, flex, bend and stretch my brain, and expand the way I think! I make great mistakes that help me learn. I have Brick Brain. With me, things are the way they are...and they're probably not going to change much. I am the way I am...and that's just how it is. Meet Bubble Gum Brain and Brick Brain: two kids with two VERY different mindsets. Bubble Gum Brain likes to have fun adventures, learn new things, and doesn't worry about making great mistakes. Brick Brain is convinced that things are just fine the way they are and there's not much he can do to change them, so why try? When Bubble Gum Brain shows Brick Brain how to peel off his wrapper, Brick Brain begins to realize just how much more fun school...and life... can be! This creative story teaches children (and adults) the valuable lesson that becoming is better than being, which can open the door to a whole new world of possibilities! Ready, Get Mindset...GROW!!

bubble gum physics: *Queen of Physics* Teresa Robeson, 2020-02-28 Meet Wu Chien Shiung, famous physicist who overcame prejudice to prove that she could be anything she wanted. "Wu Chien Shiung's story is remarkable—and so is the way this book does it justice." —Booklist (Starred review) When Wu Chien Shiung was born in China 100 years ago, most girls did not attend school; no one considered them as smart as boys. But her parents felt differently. Giving her a name meaning "Courageous Hero," they encouraged her love of learning and science. This engaging biography follows Wu Chien Shiung as she battles sexism and racism to become what Newsweek magazine called the "Queen of Physics" for her work on beta decay. Along the way, she earned the admiration of famous scientists like Enrico Fermi and Robert Oppenheimer and became the first woman hired as an instructor by Princeton University, the first woman elected President of the American Physical Society, the first scientist to have an asteroid named after her when she was still alive, and many other honors.

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Simon Singh, and Carl Sagan; for anyone curious about the workings and aims of the Large Hadron Collider, the biggest and most expensive machine ever built by mankind; for those who firmly believe in the importance of science and rational thought; and for anyone interested in how the Universe began...and how it might ultimately end.

bubble gum physics: Strengthening Forensic Science in the United States National Research Council, Division on Engineering and Physical Sciences, Committee on Applied and Theoretical Statistics, Policy and Global Affairs, Committee on Science, Technology, and Law, Committee on Identifying the Needs of the Forensic Sciences Community, 2009-07-29 Scores of talented and dedicated people serve the forensic science community, performing vitally important work. However, they are often constrained by lack of adequate resources, sound policies, and national support. It is clear that change and advancements, both systematic and scientific, are needed in a number of forensic science disciplines to ensure the reliability of work, establish enforceable standards, and promote best practices with consistent application. Strengthening Forensic Science in the United States: A Path Forward provides a detailed plan for addressing these needs and suggests the creation of a new government entity, the National Institute of Forensic Science, to establish and enforce standards within the forensic science community. The benefits of improving and regulating the forensic science disciplines are clear: assisting law enforcement officials, enhancing homeland security, and reducing the risk of wrongful conviction and exoneration. Strengthening Forensic Science in the United States gives a full account of what is needed to advance the forensic science disciplines, including upgrading of systems and organizational structures, better training, widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. While this book provides an essential call-to-action for congress and policy makers, it also serves as a vital tool for law enforcement agencies, criminal prosecutors and attorneys, and forensic science educators.

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macroscopic calculations, the Derjaguin approximation, and disjoining pressure Physics and Chemistry of Interfaces is a complete reference on the subject, aimed at advanced students (and their instructors) in physics, material science, chemistry, and engineering. Researchers requiring background knowledge on surface and interface science will also benefit from the accessible yet in-depth coverage of the text.

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bubble gum physics: Facts And Mysteries In Elementary Particle Physics (Revised Edition) Martinus J G Veltman, 2018-03-21 This book provides a comprehensive overview of modern particle physics accessible to anyone with a true passion for wanting to know how the universe works. We are introduced to the known particles of the world we live in. An elegant explanation of quantum mechanics and relativity paves the way for an understanding of the laws that govern particle physics. These laws are put into action in the world of accelerators, colliders and detectors found at institutions such as CERN and Fermilab that are in the forefront of technical innovation. Real world and theory meet using Feynman diagrams to solve the problems of infinities and deduce the need for the Higgs boson. Facts and Mysteries in Elementary Particle Physics offers an incredible insight from an eyewitness and participant in some of the greatest discoveries in 20th century science. From Einstein's theory of relativity to the spectacular discovery of the Higgs particle, this book will fascinate and educate anyone interested in the world of quarks, leptons and gauge theories. This book also contains many thumbnail sketches of particle physics personalities, including contemporaries as seen through the eyes of the author. Illustrated with pictures, these candid sketches present rare, perceptive views of the characters that populate the field. The Chapter on Particle Theory, in a pre-publication, was termed 'superbly lucid' by David Miller in Nature (Vol. 396, 17 Dec. 1998, p. 642).

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bubbles and films employs simple experiments to establish a practical basis for the existence and function of surface tension and energy minimization. Experiments require only soap, straws, and bits of rubber to impart profound fundamental concepts related to fluids. 83 illustrations. 1911 edition.

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Teller, 2013-06-29 The idea for this book began over four decades ago when Edward Teller began teaching physics appreciation courses at the University of Chicago. Then, as now, Dr. Teller believes that illiteracy in science is an increasingly great danger to American society, not only for our children but also for our growing adult population. On one hand, the future of every individual on this globe is closely related to science and its applications. Fear of the results of science, which has become prevalent in much of the Western World, leads to mistaken decisions in important political affairs. But this book speaks of no fears and of no decisions—only of the facts that can prevent one of them and indirectly guide the others. From the perspective of this book, a second point is even more significant. The first quarter of this century has seen the most wonderful and philosophically most important transformation in our thinking. The intellectual and aesthetic values of the points of view of Einstein and Bohr cannot be overestimated. Nor should they be hidden at the bottom of tons of mathematical rubble. Our young people must be exposed to science both because it is useful and because it is fun. Both of these qualities should be taken at a truly high value.

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