SENSE 'N' SCIENCE

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# PHYSICS PHENOMENA

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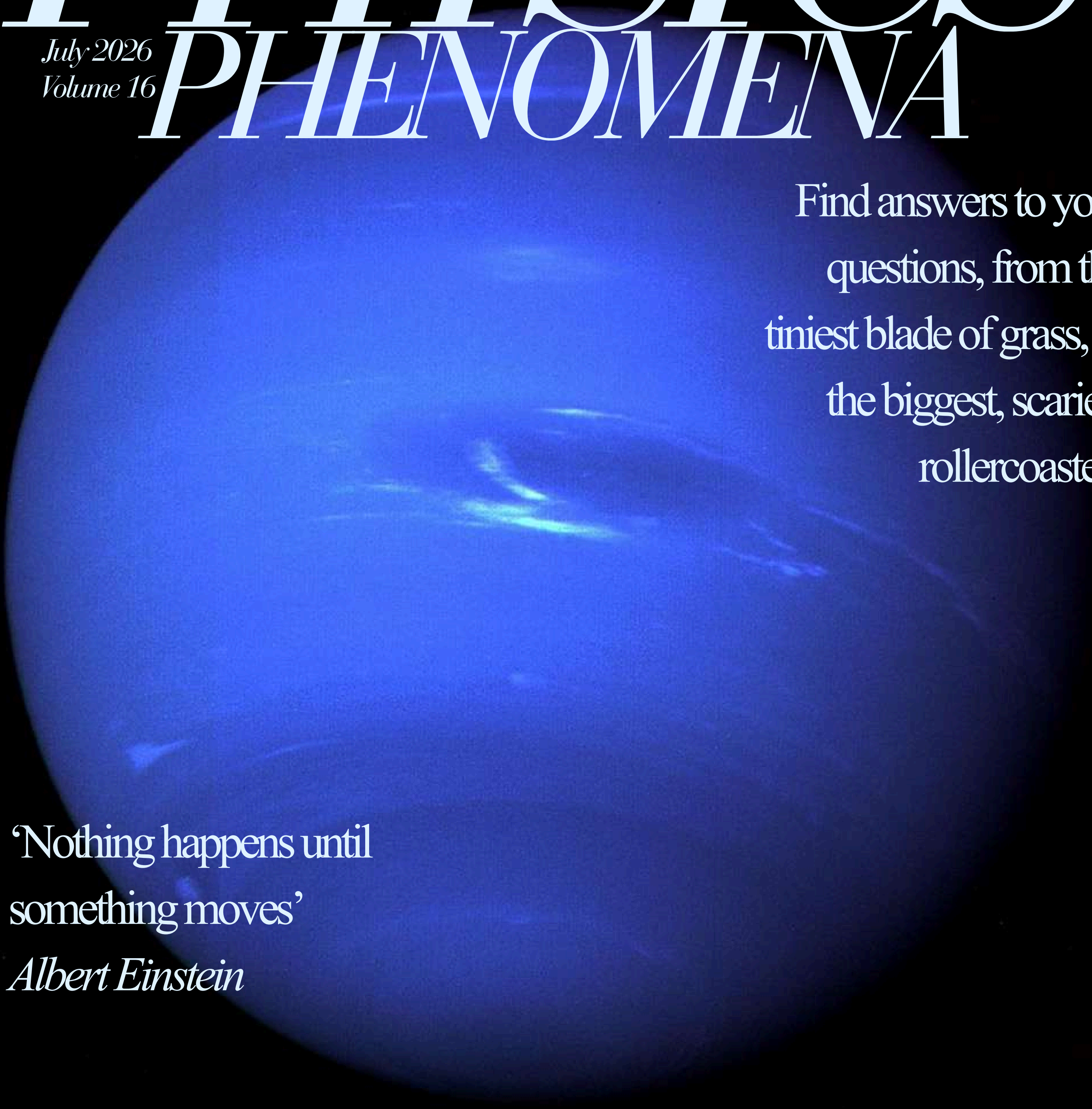

Find answers to your questions, from the tiniest blade of grass, to the biggest, scariest rollercoasters

'Nothing happens until something moves'
*Albert Einstein*

# Contents

# From the EDITOR'S DESK

*"The most incomprehensible thing about the world is that it is comprehensible"*

*The reason Albert Einstein was so intelligent, is because he was curious. It is this curiosity that led him to become one of the most famous and celebrated scientists of all time (that, and his signature hairstyle)*

*Physics is not a facet of science, but science in its entirety, and it is physics we must understand if we are to understand absolutely anything else. As Einstein said, this task is not as hard as it seems, so let's all take a page out of his book and start seeking the answers to all our questions about the universe, from the tiniest blades of grass, to the biggest, scariest rollercoasters.*

*In this magazine are articles answering the questions little kids, PhD professors and students such as you and I are asking, so we hope you take the time to gain a little more knowledge about what makes our universe tick.*

*Remember, the largest bodies in our solar system are made from the smallest particles. Start small with our magazine, and who knows how far you will get?*

*Tarana Rangwala*

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# EYE-CATCHING PHYSICS

*Tarana Rangwala IBDP 2-A*

## *PLASMA BALLS*

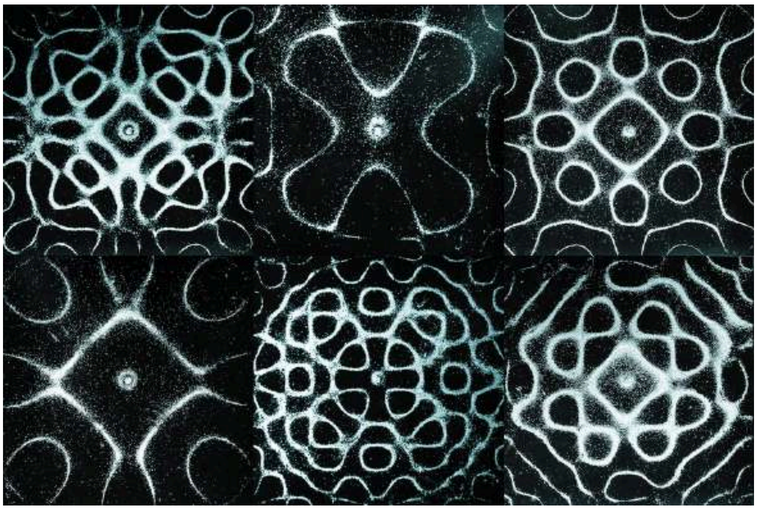
You grew up under the notion that there were only 3 states of matter, but there are more. Meet the fourth state: plasma.

It looks like we trapped lightning in a crystal ball, but inside is a high-voltage electrode that creates rapidly alternating electric fields. It is also filled with neutral gases like Argon, Neon, and Xenon. These atoms get stripped of their outer electrons and the contents become a mixture of ions, called plasma.

## *CYMATICS*

When a metal plate is vibrated by a speaker, sound waves travel across its surface. These waves reflect from the edges and interfere with one another. In some places, the waves reinforce each other, creating large vibrations called antinodes. In other places, they cancel out completely, forming stationary regions called nodes.

When you sprinkle a bit of sand onto the metal plates, it gets shaken away from the antinodes but gathers at the nodes where plate is near completely still. In the end, it looks something like a mandala or a pattern created by a human. It is the visual representation of sound!



## *LAVA LAMPS*

Inside the lamp are two liquids that do not mix. At the bottom sits a waxy substance. When the bulb heats the wax, its particles gain energy and spread farther apart. This makes it less dense than the surrounding liquid and carries it up just like a hot-air balloon rises through cooler air.

As the wax reaches the top, it moves away from the heat source and begins to cool. The particles slow down and pack closer together, and the wax's density increases. Eventually it becomes denser than the surrounding liquid and sinks back down.

This cycle of heating then rising, cooling then sinking creates *convection currents,* and makes the liquid look like burning-hot lava.

# WHY IS THERE A BIG HILL AT THE START OF EVERY ROLLER COASTER?

*Aarna Pranav Shah 10C*

That slow climb at the beginning of a roller coaster is almost impossible to forget. The steady clicking sound the gradual rise and the feeling that time has slowed down all build a strange mix of excitement and fear. You are not moving fast yet but your heart is already racing. It might feel like the hill is there just to make riders nervous but in reality that first hill is doing the most important job of the entire ride. The truth is simple. Without that big hill the roller coaster would not work at all.

The First Hill Powers the Entire Ride. Roller coasters do not rely on engines to push them around the track. Instead they depend on energy that is stored at the very beginning of the ride and then released slowly as the train moves forward. In physics energy is what allows things to move or change. Roller coasters mainly use two forms of energy. One is gravitational potential energy which is stored energy due to height. The other is kinetic energy which is the energy of motion.

When something is lifted higher above the ground it gains more gravitational potential energy. When it starts moving faster that stored energy turns into kinetic energy. A roller coaster is designed to keep switching between these two forms.

At the start of the ride the train is pulled upward by a chain or motor system. This is the only part of the ride that uses external power.

The climb is slow not because the ride wants to tease you but because lifting a heavy train full of people requires control and precision. As the train climbs it is storing energy. Every bit of height adds more gravitational potential energy. Even though the train feels slow it is actually preparing for everything that comes next.

This is why the first hill is usually the tallest part of the coaster. Its height determines how much energy the train will have for the rest of the ride. By the time you reach the top the coaster has stored the maximum energy it will ever have. Why Motors Are Not Used During the Ride? Many people wonder why roller coasters do not use motors throughout the track to keep the train moving. The reason is safety and reliability. After the first hill gravity does almost all the work. This means that even if there is a power failure the coaster can still complete the ride safely. Using gravity also makes the ride easier to predict. Engineers can calculate exactly how fast the train will move and where it will slow down.

Designing the first hill is one of the most important steps in building a roller coaster. Engineers carefully calculate its height based on the length of the track the number of turns and loops friction and rider safety. If the hill is too small the ride will not finish the track. If it is too tall the ride could become unsafe. The final design is always a balance between thrill and control.

So the next time you hear the clicking chain and feel the ground slipping farther away remember that the ride has already begun. You are watching physics quietly prepare for chaos.

# *WHY DOES A BASKETBALL BOUNCE LOWER EACH TIME IT HITS THE GROUND?*

*Kashvi Sheth 10B*

*I*magine you are playing basketball, you bounce the ball to the ground, and it bounces back up. But you notice something: after the first bounce, it bounces lower. But why? The answer lies in the fascinating world of physics.

With each bounce of the basketball, some amount of energy is lost. Let's understand it with simple physics. When the basketball is held, it has potential energy, which any object possesses due to its position and ability to do work. Once the ball is dropped, its gravitational potential energy begins to convert into kinetic energy as gravity pulls it toward the Earth's gravitational field. After the ball has finally hit the ground, the ball now has kinetic energy that is responsible for motion. After the first impact with the ground, each subsequent bounce is lower than the previous one.

This happens because some of the kinetic energy the ball once had is dissipated as heat and sound. As the rubber molecules of the ball collide with the ground, the ball is deformed for a brief moment, during which energy is released in the form of sound and thermal energy. This produces a loud sound and a slightly higher surface temperature in the ball. This is because the collision of the ground and the ball is inelastic, meaning that some energy will always be lost, and hence the ball cannot rebound to its original height.

Then there is also drag, which, although minor, can still play a huge role in this. While the ball is dropped, there is also a collision between the rubber molecules and the air molecules, which is known as air resistance or drag. Drag always acts in the opposite direction to the motion of the ball. Over time, this small effect adds up to make the ball slower and less bouncy.

Although energy loss seems to explain the topic, it is not the only thing that affects it. There are a few other factors that also affect the bounce, such as:

- Firstly, the air pressure inside the ball makes a significant difference. The ball should be well-inflated so that it is more elastic and has an elastic collision. This will give a better energy return. However, if the ball is not inflated enough, it will absorb more energy, resulting in a much lower bounce.
- Secondly, the type of surface matters. Basketballs tend to bounce higher on hard surfaces such as concrete or tiles, whereas they bounce lower on softer surfaces like carpets or grass. This happens as a result of the amount of energy absorbed by the surface.
- Lastly, the temperature of the ball will change the bounce limit. Rubber properties change with temperature. A colder ball will have less elasticity and hence a lesser bounce. This is why the ball should be slightly warmer, as it will possess more elasticity and will give a higher bounce.

These factors show that the bounce of a basketball depends not only on energy loss but also on surrounding conditions.

The dissipation of energy, the conversion of energy from one form to another, drag, and energy transfer all add up to finally stop the ball. After all energy has been transferred and dissipated into the surroundings, the ball will eventually stop. So the next time you dribble a ball, remember the science behind it!

# WHY DO GUITAR STRINGS SOUND DIFFERENT WHEN THEY'RE SHORTER?

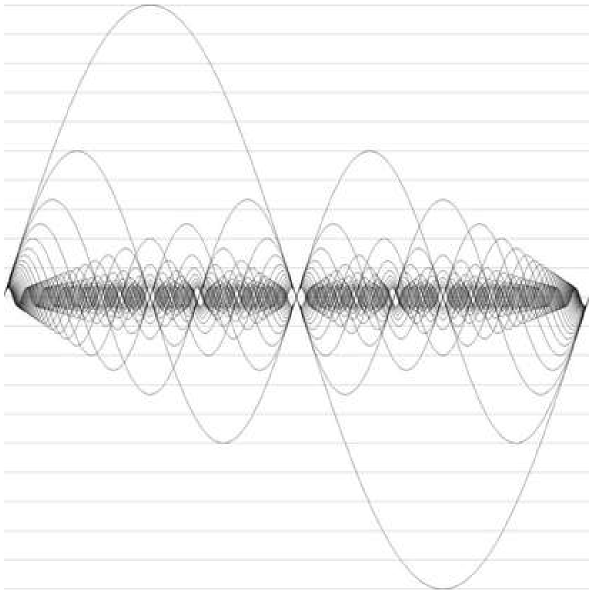
*Tarana Rangwala IBDP 2-A*

What will a jump rope teach us about music? Get two friends: ask them to stand apart and spin the rope, then ask them to stand closer and do the same thing. The size of the wave created by the rope gets smaller, and at the ends, there is never any movement at all. The jump rope, like a guitar string, has two fixed ends, that stop the wave from travelling any farther than the length of the string. These types of waves are called *stationary waves*.

A guitar string is anchored at two points: the bridge near the body, and the fret near the headstock. When a guitar player presses a fret, it is the same as making the string shorter, because when they strum it the part that is free to oscillate gets shorter. The length determines the maximum frequency, or pitch that you hear. That's how a guitarist can change the notes she plays depending on which fret she presses.

Short strings sound higher-pitched, which means they have higher frequencies, or are vibrating back and forth, really, really fast. Longer strings have much more ground to cover, so they are a lot slower, and can sound deeper, like lower pitched sounds do. How to use these strings is really up to the guitarist, because by changing the combination of notes and chords she plays, she can create a wide range of unique sounds. When she adds all those sounds together, she can make a song.
A string pinned at both ends can actually vibrate in several patterns at the same time. Each pattern is called a harmonic.

The largest arc is the fundamental. That's the one you can see clearly when you spin the jump rope. But on a guitar string, you can see even more. Look at the image at the top. For a string with two fixed ends of constant length, all these vibrations are happening at once. But the oscillations add up at each point on the string, so what we see is the sum of all of these waves acting together.



Your ears are hearing a whole mix of sounds as one note, but not all instruments have the same combination of harmonics, which change the *timbre*, or the feel, of a sound. That's why a guitar sounds a lot less angelic than a harp, even if they play the same note.

For a string of length L, fixed at both ends, the allowed frequencies are:

$f(n) = n \cdot v / (2L)$

- L = the vibrating length of the string
- v = how fast a wave travels along the string (depends on tension and thickness)
- n = a counting number (1, 2, 3...) telling you which harmonic
- f(n) = the frequency of that harmonic

Every whole-number harmonic combination is possible, which is why a plucked string sounds so *full*. And because length and frequency are inversely related, halving the length of a string bumps the sound up exactly one octave.

Whether you play the guitar or not, look our for these harmonics the next time you see one.

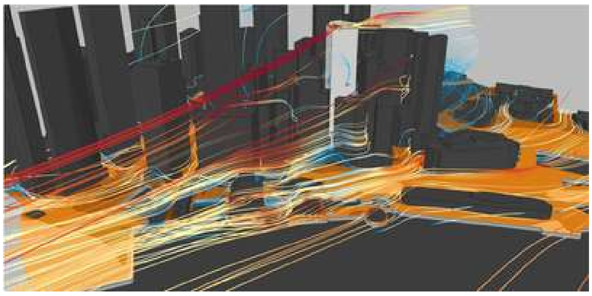
# WHY DO TALL BUILDINGS SWAY IN STRONG WINDS?

*Dharmit Shelat IBDP 2-A*

Skyscrapers are impressively tall structures reaching hundreds of meters into the sky. Although they appear strong and unshakeable, they are actually designed to move slightly when strong winds blow. This small movement is called sway. Engineers intentionally allow tall buildings to sway because it helps the structure safely absorb the forces caused by wind.

Wind Forces on Skyscrapers

When wind flows around a building, it creates pressure on its sides. The taller the building, the stronger the wind forces it experiences. Wind pushes against the building and creates sideways forces. According to physics, when a force acts on an object, it can cause motion at times. In very tall buildings this force causes the structure to bend slightly and move back and forth. This movement is usually very small and slow, barely felt by people inside.



Why Buildings Are Designed to Move

Many people believe buildings should be completely rigid. However, if skyscrapers were perfectly stiff and rigid, strong winds could create huge stresses in the structure. These stresses might damage or even cause structural failure in these buildings. Engineers therefore design tall buildings to be flexible. By allowing small amounts of movement, the building can safely absorb energy from the wind and reduce long-term risks and costs of repair.

Tuned Mass Dampers

To control the amount of sway, engineers often install special devices called tuned mass dampers near the top of the building. A tuned mass damper is very heavy weight that moves in the opposite direction of the building's motion. When the building sways one way, the mass shifts the other way. This counter movement reduces vibrations and helps keep the building stable. The most famous examples of these devices include the giant steel sphere inside Taipei 101 and Burj Khalifa which weigh hundreds of tons and helps stabilize the skyscraper during strong winds.

Building Shape and Engineering Design

Modern skyscrapers are carefully designed to reduce wind pressure. Architects often use twisted shapes and structures that allow wind to flow smoothly around the building instead of hitting flat surfaces. Engineers also test scale models of buildings in wind tunnels to study how air moves around them. With the rising innovation in technology, computer simulations and advanced materials enable structural designs that look dynamic and are stable and resistant.

Tall buildings sway in strong winds because wind exerts sideways forces on them. Instead of resisting these forces completely, engineers design skyscrapers to bend slightly and safely absorb the energy. Technologies such as tuned mass dampers and aerodynamic building shapes help control this movement. Thanks to modern engineering, skyscrapers around the world remain safe, stable, and comfortable even in very windy conditions.

# WORD SEARCH

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*Frame of Reference*
*Component Vectors*
*Acceleration*
*Freefall*

*Constant Velocity*
*Displacement*
*Mechanics*
*Scalar*

*Projectile Motion*
*Constant Speed*
*Kinematics*
*Distance*

# DOES CONCRETE MAKE BALLS BOUNCIER THAN GRASS?

*Aayush Chudasama IBDP 2-A*

If you drop a ball on a concrete road, it will bounce back up quickly. On the contrary, if you were to drop the same ball on grass, the bounce would be both slower and less in height, sometimes it might barely bounce at all. Prima facie, it might seem obvious that this happens because concrete is hard while grass is soft. But that simple explanation does not do justice to the deeper, interesting reason rooted in physics. So, let's investigate what truly determines how "bouncy" a surface is.

First, we need to look at what happens to the ball and the ground during a bounce.

What Happens When a Ball Hits the Ground?

When a ball falls, it gains kinetic energy (the energy due to motion) due to the force exerted by the Earth called gravity. At the instant it hits the ground, that energy doesn't disappear; due to the law of conservation of energy, energy can neither be created nor destroyed, it just gets transferred. Some of it is retained by the ball as elastic energy (potential energy stored by an object when deformed), and then converted back into motion (kinetic energy) as the ball rebounds. But, not all of the energy is recovered. Some is lost in the form of heat, sound and friction between the ball and the surface. Because of this loss of energy, the ball never returns to its original height.

We can measure how "bouncy" a collision is using something called the coefficient of restitution. It is the ratio of how fast the ball moves after the bounce to how fast it was moving before impact.

e = impact velocity/ rebound velocity

A value closer to 1 means there is a very bouncy collision (little energy is lost), while a value closer to 0 means most of the energy is absorbed,i.e., it's a less bouncy collision.

What's the Real Difference between Concrete and Grass?

Now that we know the science of bounciness, let's look at concrete and grass using this idea.
Concrete is highly rigid. When a ball hits it, the surface barely deforms. Almost all the deformation happens to the ball only. So, very little energy is absorbed. Hence, there is less energy loss, i.e., most of the stored elastic energy returns to the ball, leading to a greater bounce. In scientific terms, the coefficient of restitution is relatively high.

In contrast to concrete, grass is soft, with flexible blades of grass, loose soil and air pockets.
When a ball lands on grass, the surface compresses and absorbs energy. Also there is significant friction between the grass blades and the ball. This means less energy is retained by the ball, resulting in a lower bounce height and speed.

Conclusion
So, to answer the question: Does concrete make balls bouncier than grass? The answer is yes, but not simply because it is a "hard surface". The precise reason is the energy lost during the collision. In concrete, most of the energy is retained by the ball, while grass absorbs a significant portion of it. This difference in energy transfer leads to a higher bounce on concrete and a lower bounce on grass.

# CAN SOUND REALLY CANCEL SOUND?

*Tanishq Shukla 10B*

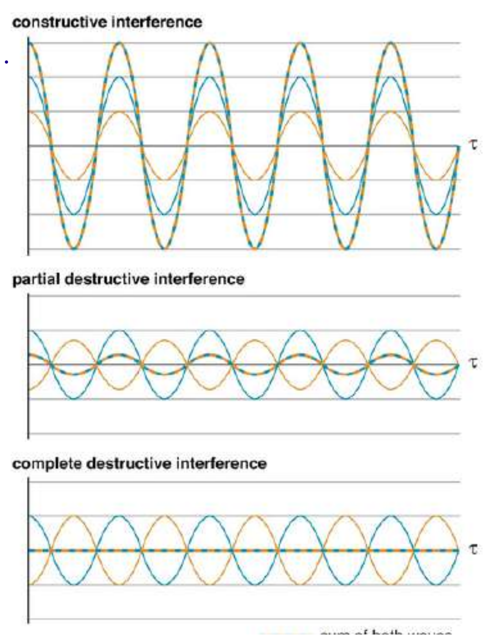
Imagine sitting on a noisy bus, car, or airplane, surrounded by the hum of engines and the chatter of people. You put on your noise-cancelling headphones, switch them on, and suddenly the world feels quieter. It almost feels like the sound has disappeared. But how is that possible? Can sound really cancel sound? The answer lies in a fascinating scientific principle called Active Noise Cancellation (ANC), where sound is used to reduce unwanted sounds.

Can Sound Cancel Sound?

The interesting thing is that yes, sound can cancel other sounds. When two sound waves meet, they interact. If the peaks of both waves line up, they combine to produce a louder sound. This is called constructive interference.

However, if the peak (the highest point) of one wave meets the trough (the lowest point) of another, they cancel each other out through destructive interference. When this happens perfectly, the waves flatten, making the sound much quieter—or even disappear altogether.

It might seem strange that adding sound can make something quieter, but it works because the second sound wave is the exact opposite of the unwanted noise. This principle forms the basis of Active Noise Cancellation (ANC) technology, reducing background noise while keeping the sound you want to hear clear.




How Do Noise Canceling Headphones Create Anti Noise?

Noise-cancelling headphones do not simply block sound like ordinary earplugs. Instead, they actively reduce unwanted noise using ANC technology. Tiny microphones inside the headphones constantly listen to the sounds around you, picking up background noise such as airplane engines or traffic.

The headphones then use a small built-in processor to analyze these sound waves. Within a fraction of a second, the system creates a new sound wave that is the exact opposite of the unwanted noise. This opposite wave is played through the speakers, and when the two waves meet, they cancel each other out through destructive interference. All this happens so quickly that you simply experience a quieter environment. Instead of physically blocking sound, ANC reduces it using science and precise timing.

When Does ANC Work Best?

Even though ANC is very effective, it does not remove every type of sound equally. It works best for constant, low-frequency sounds such as the steady hum of an airplane engine, a fan, or traffic. These sounds are predictable and continuous, making it easier for the headphones to create an exact opposite wave.

However, sudden sounds like clapping, shouting, or a door slamming are harder to cancel because they change too quickly for the system to react perfectly.

Noise-cancelling technology was first developed to reduce noise for airplane pilots. Today, it is used by students, travelers, and office workers to create a quieter environment.

So, can sound really cancel sound? The answer is yes. Through the principle of destructive interference, one sound wave can be used to reduce or even cancel another. Noise-cancelling headphones use ANC to detect unwanted noise and create an opposite sound wave before it reaches our ears.

# WHY DO WE SLIP ON WET FLOORS MORE EASILY THAN DRY ONES?

*Tanya Patel IBDP 2-A*

Have you ever walked across a wet floor and suddenly felt your feet slide beneath you? Whether it is a freshly mopped classroom, a rainy sidewalk, or a spill in the kitchen, wet surfaces can be surprisingly slippery. This common experience is more than just an inconvenience—it is an example of an important concept in physics known as friction. Understanding why we slip more easily on wet floors helps explain how forces affect our everyday movements and why safety signs are often placed around wet surfaces.

Friction is the force that resists motion between two surfaces that are in contact. When you walk on a dry floor, the soles of your shoes grip the surface because microscopic bumps and irregularities on both surfaces interlock. This friction provides the traction needed to push against the ground and move forward without sliding. The greater the friction between your shoes and the floor, the easier it is to maintain balance and control while walking.

When a floor becomes wet, the situation changes significantly. Water forms a thin layer between the floor and the sole of the shoe. Instead of the rough surfaces directly touching one another, they are partially separated by this layer of liquid. As a result, the microscopic bumps can no longer interlock as effectively. This reduces the frictional force between the shoe and the floor. With less friction available, the foot may slide unexpectedly when force is applied during walking.

The slipping process happens very quickly. As you take a step, your foot pushes backward against the floor. Under normal conditions, friction provides an equal forward force that helps you move ahead. However, on a wet surface, the reduced friction may not be strong enough to support this motion. If the force from your step exceeds the available friction, your foot begins to slide instead of grip. This sudden loss of traction can cause a person to lose balance and fall.

Several factors affect how slippery a wet floor becomes. The type of flooring plays an important role. Smooth surfaces such as polished tiles or marble tend to become more slippery when wet because they already provide less friction than rough surfaces. The type of footwear also matters. Shoes with textured rubber soles generally provide better grip than shoes with smooth soles. In addition, substances such as soap, oil, or detergent mixed with water can make a surface even more slippery by reducing friction further.

Understanding friction has led engineers and designers to create safer environments. Non-slip floor materials, textured surfaces, rubber mats, and specially designed shoe soles all help increase friction and reduce the risk of accidents. Warning signs placed near wet floors also remind people to walk carefully when traction may be reduced. The next time you see a "Caution: Wet Floor" sign, remember that it is not just a routine warning. A simple layer of water can dramatically reduce friction, making it much easier to slip. By understanding the science behind this everyday phenomenon, we can better appreciate how physics influences our safety and movement in the world around us.

# QUIZ

*Can you guess what makes the world go round? It's not just the sun...*

*1. Why does popcorn "pop"?*

A) The corn explodes chemically
B) Water inside the kernel turns to steam and bursts it open
C) Air gets trapped inside
D) The shell melts

*2. Why does your phone screen sometimes look dark when you're wearing polarized sunglasses?*

A) The glasses block certain light vibrations
B) The screen turns itself off
C) The glasses absorb all light
D) The screen reflects sunlight

*3. Why do stars twinkle but planets usually don't?*

A) Stars change brightness constantly
B) Earth's atmosphere bends starlight more noticeably because stars appear as tiny points
C) Planets are too bright to twinkle
D) Planets are closer to Earth

*4. Why can you hear someone talking around a corner even when you can't see them?*

A) Sound waves can diffract (bend) around obstacles
B) Sound travels through walls only
C) Light is slower than sound
D) The corner reflects voices perfectly

*5. Why does your voice sound strange when you hear a recording of yourself?*

A) The microphone changes your voice
B) Recordings remove low frequencies
C) You normally hear your voice through both air and vibrations in your skull
D) Your brain edits your voice in real life

*ANSWERS*
*1)B, 2)A, 3)B, 4)A, 5)C, 6)B, 7)B, 8)C, 9)C, 10)B*

*6. Why do ice cubes sometimes crack loudly when dropped into a drink?*

A) The ice is breaking under its own weight
B) Rapid temperature changes create internal stresses in the ice
C) Air trapped inside explodes
D) The drink chemically reacts with the ice

*7. Why can you sometimes see your breath on a cold morning?*

A) Your breath becomes smoke
B) Tiny water droplets condense from warm, moist air you exhale
C) Cold air is visible
D) Carbon dioxide reflects sunlight

*8. Why does a spinning bicycle wheel become harder to tip over?*

A) The wheel becomes heavier
B) Air resistance holds it upright
C) Angular momentum resists changes to its orientation
D) Gravity weakens while it spins

*9. Why do distant mountains often appear blue?*

A) Mountains are naturally blue
B) Plants on mountains reflect blue light
C) The atmosphere scatters blue light between you and the mountain
D) Water vapor acts like a blue filter

*10. Why do microwave ovens have metal mesh on the door instead of solid glass?*

A) The mesh strengthens the door
B) The holes are too small for microwaves to escape but large enough for visible light to pass through
C) Microwaves can only travel upward
D) The mesh absorbs all radiation

# HOW DOES A MICROWAVE MAKE MY FOOD HOT BUT KEEP MY PLATE COOL?

*Kshamya Hundia 10B*

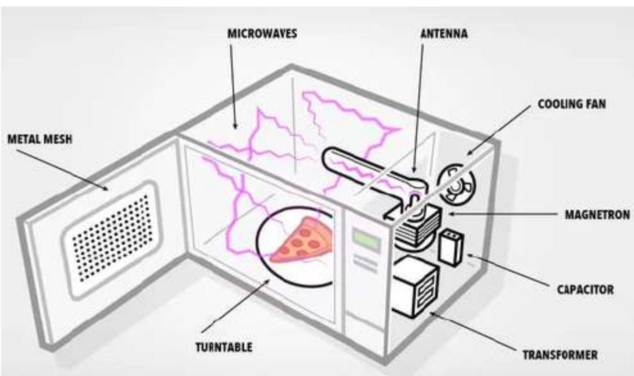
People use microwaves to prepare popcorn and reheat leftover food yet the appliance operates through very different methods than the ovens we normally use. A microwave cooks food through electromagnetic energy which interacts with the food molecules while a conventional oven needs to warm its internal air space in order to cook food from its outer surface. The soup remains hot because of boiling yet the bowl stays cold because of this fact.

Generating the Waves

A magnetron is the first element in the process. This apparatus generates microwaves, which are a byproduct of electricity. These waves reflect off the metallic walls after being introduced into the main compartment. This energy is then trapped inside the metal, and travels through the food from a number of directions since the waves are reflected and not absorbed.

The Role of Water Molecules

The reason why microwaves can heat food so efficiently is that most food items contain a high percentage of water which exists as H2O and water molecules exhibit a dual charge distribution through their molecular structure because of their water-based content. The microwaves generated in the oven create a rapidly oscillating electromagnetic field.




The water molecules which have polar characteristics always attempt to align themselves with the oscillating electromagnetic field. The water molecules undergo positional changes at a rate of one billion times each second because the oscillation process occurs repeatedly. The rapid oscillations create friction between water molecules. The friction between billions of water molecules produces heat which spreads to the rest of the food through conduction just like friction between our hands produces heat.

Why Doesn't the Plate Get Hot?

A question that may come to mind of the people is, “Why does the container remain cool but food inside it becomes hot?”. The molecular structure of the materials is, therefore, responsible for this phenomenon. Glass, ceramics, and most plastics have non-polar molecules, which means that their molecules do not have a “positive and negative ends”, like the molecules of water. Therefore, these non-polar molecules are insensitive to changes in the electromagnetic field, and the microwaves simply go through them without causing any vibration. This is to say that the plate will in no way be heated by the microwaves but in case it feels hot to touch, it is probably because it has come into contact with the food and gained heat that way. This can be explained by the fact that there are water and metal impurities in the glaze on the surface of some ceramics which explains why some (non-microwave-safe) plates can be extremely hot to the touch.

The Danger of Metal

The microwave oven should never have metal objects inside it according to the warnings which you should have received. The microwaves will not damage the microwave oven wall which has a thick smooth surface but any metal object including aluminum foil and forks will create a hazardous situation.

The microwaves will cause electrons in these metal objects to move rapidly throughout the entire metal structure. The electrons will leave the body toward the closest area in the atmosphere which produces an electrical arc that resembles a short lightning bolt Bond 1. The microwave oven will sustain extensive damage from this electrical discharge.

Conclusion

The microwave oven demonstrates how people use physics principles to develop better solutions for their daily activities. The knowledge of how electromagnetic waves interact with polar molecules enables cooks to prepare meals which require only a fraction of the time needed for traditional oven cooking. The microwave oven starts its process through a smart use of friction and biological principles which occurs when you press the "Start" button.

# *HOW DO SUNGLASSES REDUCE GLARE ON SUNNY DAYS?*

*Tanya Patel IBDP 2-A*

Have you ever walked out while the sun was bright and high, squinting when the beams of sunlight, reflecting off of the black asphalt, caught your eye? Most people will instinctively reach for their sunglasses to comfort their vision without ever knowing the science behind this structurally simple yet functionally effective object. But the science lies right at the surface, in the interactions between the sunlight and the strategically designed lenses. This science builds up from the first step: sun glare.

Sun glare is the painful or distracting light that interferes with your vision ("What Is Sun Glare?"). This glare is the result of violent light, direct or reflected, entering the eyes and flooding the retina, momentarily hampering vision. Majority of the times, we experience glare as a result of reflection from different surfaces. In fact, some surfaces are exceptionally effectual at creating glare. For instance, snow is the most effective surface at producing harsh glares due to its ability to reflect up to 80% of the sunlight. By contrast, the other surfaces such as water, glass, and road reflect within the range of 5-20%.
uckily, sunglasses can protect us from this harmful glare thanks to their ability to block this glare through tinted absorption, metallic mirror coatings, and polarisation filters. Apart from plummeting brightness, tinted lenses provide extra benefits. They help make vision extremely comfortable by selectively sifting certain wavelengths of light, lessening severe glare, and regulating the volume of visible light transmission.

Despite such glories of sunglasses, an ordinary pair is not the ideal answer. As regular sunglasses block bright light but usually fail to eradicate the reflected horizontal glare. Due to the standard tinting merely darkening your vision, this reflected light proceeds to cause eye strain, decreases visual contrast, and produces lethal blind spots. To comprehend a better solution, we must investigate polarization. Polarization refers to the process of filtering out certain types of light waves. In the case of polarized sunglasses, this filtering process reduces reflected light, glare, and other unwanted light waves to provide clearer and sharper vision (Chan). Thus, polarized sunglasses are more effective than ordinary sunglasses as a result of their superior glare reduction, enhanced clarity and contrast, and better vision in nature.

The advantages of glare reduction are immense. It exponentially enhances vision through contrast intensification and visual haze diminution. Further, it prevents the eye muscles from tiring out by the constant altering to dangerous glares; this eases headaches and fatigue. Importantly it produces blinding reflections making outdoors activities like driving, boating, fishing, and sports safer.

Keeping in mind all these benefits, sunglasses prove a purpose far beyond aesthetics. So, the next time you put on a pair of shades, reminisce over the fact that they are doing much more than completing your outfit. Those dark lenses have a crafty purpose of science that aids your eyes in dealing with the downsides of too bright a light. Engaging with the science of sunglasses, especially polarized lenses, assists us in being grateful for how a simple day-to-day object can play a crucial role in shielding our vision and refining our routine.

# *HOW DO WIRELESS CHARGERS POWER YOUR PHONE WITHOUT WIRES?*

*Tanya Patel IBDP 2-A*

Placing your phone onto a sleek pad and watching the green numbers pop onto the screen feels like magic, however it is really just pure physics. The application of wireless charging such as smartphones, smartwatches, earbuds, and other electronic devices. As technology enhances into something more accessible and portable, wireless charging is exponentially increasing in popularity. The question springs to mind: how can electricity transfer from a charging pad to our mobiles in the absence any external wire connection? The answer lies in the science of electromagnetic induction, a technology that relies on a process called magnetic induction, moving electricity through the air via paired copper coils.

This principle of electromagnetic induction was discovered by scientist Michael Faraday in the nineteenth century. The interior of the charging pad consists of a coil of wire called the transmitter coil. While electricity travels across this coil, it produces an altering magnetic field about it. This magnetic field comprises energy that can be transmitted through the air over a short distance. At the heart of your smartphone is another coil called the receiver coil. Placing the phone on the charging pad changes the magnetic field when it interacts with the receiver coil and induces an electric current. This current is then used to charge the phone's battery.

There are multiple steps to this charging process. Foremost is the electric energy from the wall socket entering the charging pad. Then, the transmitter coil on the interior of the pad converts this energy into a magnetic field. Thereafter, the receiver coil inside the mobile captures the magnetic energy and changes it back into electrical energy.

The mobile’s charging circuit then changes this energy into the form required by the battery. Finally, the battery stores the energy for later use. For this process to work efficiently, the phone must be positioned correctly on the charging pad. If the coils are not aligned properly, charging can become slower or may stop altogether.

There are numerous advantages to wireless charging. One of the most evident advantage is th convivence it offers. Users simply place their device on a charging pad instead of connecting cables. This reduces wear and tear on charging ports, which can become damaged after repeated use. Wireless chargers also help keep desks and bedside tables less cluttered by reducing the number of cables needed. In addition, many charging stations can charge multiple devices at once, making them useful for homes, offices, and public spaces such as airports and cafés.

Despite its benefits, wireless charging has some limitations. It is generally slower than modern wired charging technologies and can be less energy-efficient because some energy is lost as heat. Devices must also remain very close to the charging pad during the charging process. However, researchers are working on ways to improve wireless power transfer. Future systems may allow devices to charge from greater distances, potentially eliminating the need for charging pads altogether.

Wireless charging demonstrates how scientific discoveries can transform everyday life. By using electromagnetic induction, these devices transfer energy safely and efficiently without direct physical connections. Although the technology still has room for improvement, it represents an exciting step toward a future where powering our devices becomes even more seamless and convenient.

Why Is There a Big Hill at the Start of Every Roller Coaster?

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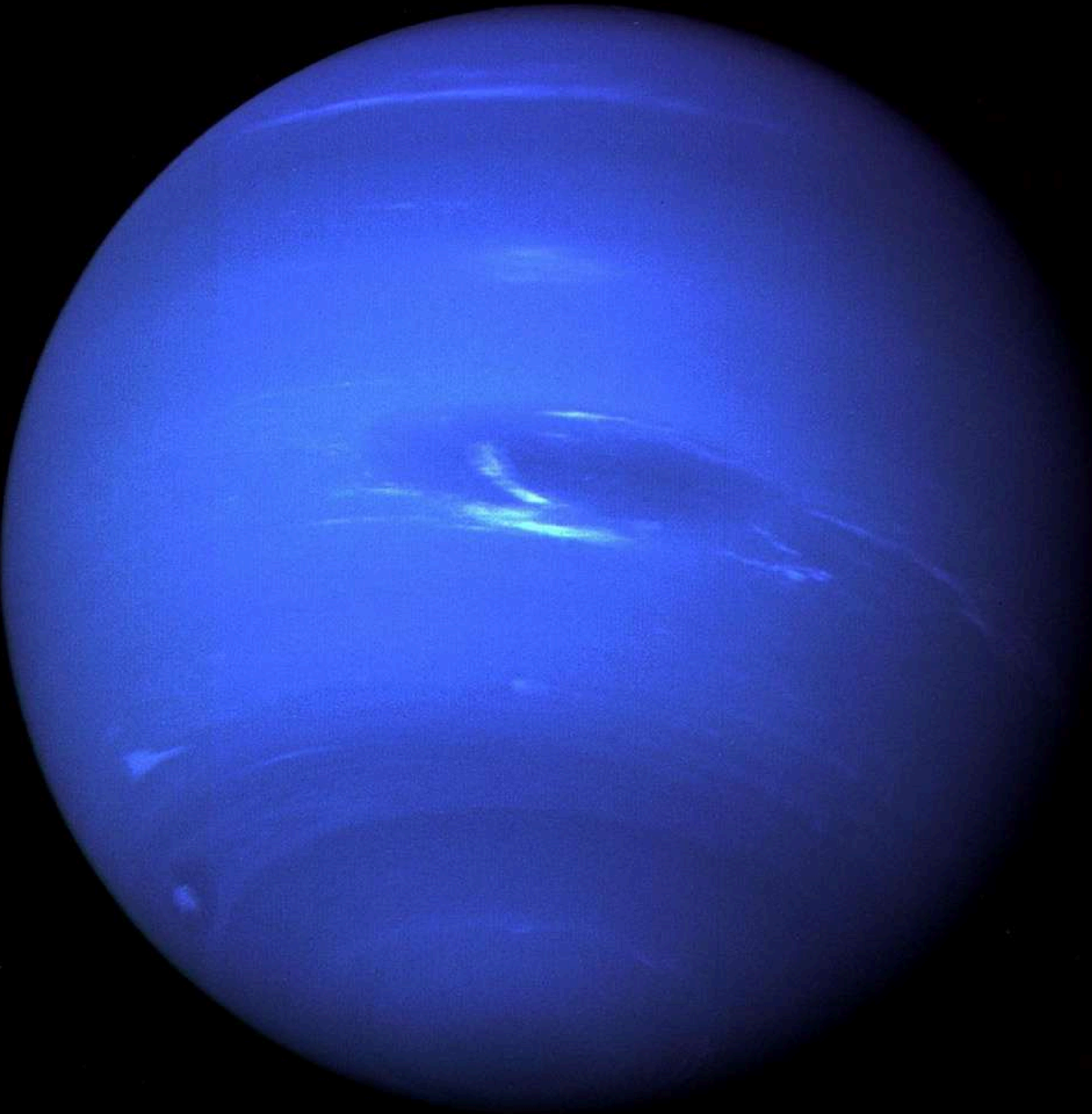
# WORKS CITED

*We sincerely thank our mentors, every writer, proofreader, and designer that made this magazine unique*

"Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world." *Albert Einstein*



Ending this edition with one more quote by the man made famous by his hair (among other things), we hope it inspired you and your imagination.

*Sense 'n' Science*

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