"Idongetit" Tales

Kevin and Melbourne Learn About … Gravity

Kevin and Melbourne sit in the library with their 8th grade science books out in front of them. Melbourne leans over his book, trying to answer the questions at the end of the chapter (without reading the chapter, of course) so that he can go home as soon as possible. Kevin's eyes glaze over as he stares at the wall, not even pretending to read.

Who cares about acceleration and air resistance and friction, anyway?

Sunny walks into the room, "KEVIN! What are you doing?"

"Science."

Sunny looked at the spot on the wall that Kevin had been staring at, "You don't look like you're doing science."

"Idongetit," Kevin mumbles… and suddenly the room starts to spin. The books and the chairs, and Sunny and Melbourne, everything turns in a giant swirl of colors. Then Kevin sees open sky and feels the wind rushing against is face: he's moving upward. He's sure of that. "Oh man…" he mutters. He did it again. The EdBoost Curse…. He's been sucked into the vortex into "Idongetit" land. Kevin sighs, waiting to land and see what hits him next. And Melbourne too, who got sucked along for the ride.

When everything stops spinning, Kevin looks around. He sees Melbourne and a little old man. They seem to be on the top of a really, really tall building – or maybe it's a mountain. It's hard to tell because he's so tiny, big things look really, really big.

"Oh, great," Kevin says, "Not only did we get moved, but we got shrunk!"

"Yeah!" says Melbourne, "And I was doing my work this time!"

"Whatever."

"Uh…hmmm," coughs the little old man.

Kevin and Melbourne look at each other, "Who's this dude?"

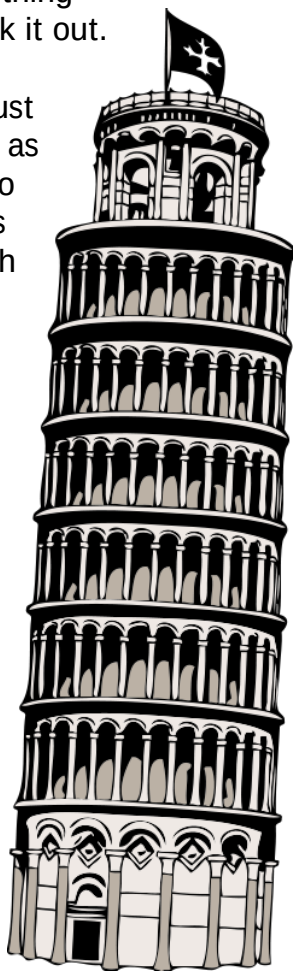
"I am Galileo Galilei[1]…"

Kevin and Melbourne giggle.

"I am Galileo Galilei," the little man repeats himself louder this time, thinking that these two nitwits might be too silly to help him out anyway, "And I believe that you have been sent to help me out with some experiments."

Kevin and Melbourne look at each other again, "O…. kay….."

"Here's the situation, Aristotle[2], that old crazy philosopher, HE thinks that a ten pound brick should fall faster than a one pound brick. I think he's wrong. He insists that it's only logical that something heavy will fall faster than something light. SO, I want to check it out. You know, do an actual experiment, instead of just THINKING about things, as those philosophers like to do. So…." Galileo pauses for dramatic effect, "Each of you is going to strap onto one of these bricks and I am going to drop you off the top of this tower."



"We're going to do WHAT? And you're going to do WHAT?" Melbourne yelps.

"This tower," he says, pointing over the ledge they stand on, "The Tower of Pisa…. Otherwise known as the Leaning Tower of Pisa[3] given that it's not quite straight."

Kevin and Melbourne look down. It's a LONG drop to the ground. On... bricks?

"That's right, that's right" Galileo says, strapping tiny helmets on each of them. "Buckle in." And before they know what's going on, Kevin and Melbourne are sitting on top of bricks (which are much bigger than their tiny selves) and strapping on tiny seatbelts. The bricks are the same size, but Galileo tells them one is much heavier than the other. Kevin will ride the ten-pound brick and Melbourne will ride the one-pound brick.

Galileo calls his assistant, "One, two, three!"

And the next thing that Kevin and Melbourne know, they've been pushed right off the ledge of the Leaning Tower of Pisa, while sitting on bricks!

As they go off the ledge, Melbourne mutters, "Um... do bricks fly, by any chance?"

On the heavier brick, Kevin calls out, "See ya, Sucker!" He knows that the ten pound brick will definitely land before the one pound brick.

But shockingly, Melbourne keeps up. They fall neck-and-neck, all the way down. They fall at the exact SAME speed, all the way to the bottom.

BLAM! They land.

"Cool!" They shout as, luckily, they land in a bucket of pasta (they are in Italy, right?) that Galileo was smart enough to put at the bottom of the tower. They unbuckle and crawl out of the bucket, picking bits of spaghetti out of their hair.

"Whoo-hoo! I knew it! I knew it! I was right, I was right!" Kevin and Melbourne get out of the way because Galileo is jumping all over the place ("How did HE get down there?" the boys wonder). "I knew it! Everything falls at the same speed! Take that Aristotle! No matter what something weighs, it falls at the SAME speed! Whoo hoo! My theory of gravity is correct!" Galileo goes spinning around and Kevin and Melbourne think that the vortex just might take them back home.

Review Questions:

1. How do Kevin and Melbourne end up in Galileo's time?

2. Based on what you have read, what is Galileo's job or profession?
    a. Philosopher
    b. Teacher
    c. Scientist
    d. Assistant

3. Why does Galileo choose two bricks that are different weights for the boys to ride?

4. Why is Galileo so excited at the end?
    a. He proved his theory that everything falls at the same speed.
    b. The boys did not get hurt in the experiment.
    c. He is smarter than Aristotle.
    d. He proved that bricks fall quickly.

5. What do you think the theory of gravity probably is?
    a. Bricks fall at the same speed.
    b. The Leaning Tower of Pisa has a special gravitational field.
    c. All objects fall at the same speed.
    d. Heavier objects fall more quickly than smaller objects.

What do the following words mean *in the context of the passage*? (Words are underlined in the passage.)

6. Vortex
    a. A swirling mass of air or fluid
    b. Shiny objects
    c. A lot of science
    d. A secret code word

7. Experiment
    a. A trick to get children to do adult work.
    b. A science quiz.
    c. A hands-on project.
    d. A scientific way of testing a theory.

8. Philosopher
    a. Someone who studies history.
    b. Someone who studies deep questions in all areas.
    c. Someone who studies geology.
    d. A scientist who performs experiments.

9. Logical
    a. Fictional, untrue.
    b. Whimsical, fanciful.
    c. Reasonable, rational.
    d. Strong, unbreakable.

10. Dramatic
    a. Sad, mournful.
    b. Creating suspense.
    c. Waiting.
    d. Playful, having fun.

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[1] **Galileo Galilei** (1564-1642) has been called the father of modern astronomy and the father of modern science. Galileo died under house arrest for saying that the earth revolved around the sun (at a time when most people, and the Roman Catholic Church believed that the sun revolved around the earth). Galileo was right, but no one knew it then. A popular story says that Galileo dropped balls of different masses from the Leaning Tower of Pisa to show that objects of different masses drop at the same rate. However, there is no record that he actually performed the experiment; he probably just thought about it. However, now we know that if he had performed the experiment, he would have been proven right

[2] **Aristotle** (384 BC – 322 BC) was a Greek philosopher wrote thought and wrote extensively about physics and whose physics ideas were influential for centuries (even if many of the ideas were eventually proven wrong). As a philosopher, Aristotle was more into thinking and talking about ideas than trying to prove them scientifically.

[3] The **Tower of Pisa** is the bell tower of the cathedral of the Italian city of Pisa. The tower leans to the side, thus the nickname, "The Leaning Tower of Pisa." Before it was restored in 1990, the tower leaned approximately 5 degrees; after restoration, it leans about 4 degrees. Because the tower is nearly 190 feet tall, even such a small lean is quite visible. he top of the tower is about 12 feet over from where it would be if the tower were perfectly straight. Work on the tower began in 1173 and it began to lean before the second floor was even complete. However, despite the lean, the tower has stood for over 800 years and architects estimate that, after a recent restoration, it should be stable for at least another 200 years. Rumor has it that Galileo dropped cannonballs from the Tower of Pisa to test his theory of gravity, but because the story (which was told by Galileo's secretary) cannot be collaborated, it is considered to be a myth.

Kevin and Melbourne Learn About … Air Resistance

Kevin and Melbourne look around, and look around, sure that the vortex will sweep them up any second. They helped out an old guy, surely that was enough work for the day.

But then, instead of the vortex, they hear, "Well… sir, not everything falls at the same speed– at least not here on earth."

As soon as they see the other old man, Kevin and Melbourne know that they aren't going anywhere soon.

Galileo looks at the other little man, "Newton! What are you doing here? You won't be born for another….40 years!"

"I am Sir Isaac Newton[4], and if these two punks can travel through time, I certainly can too. Especially if I need to help you clarify a point."

Melbourne and Kevin look at each other, "Oh boy…."

"Do you think we can escape without them noticing?"

"Where are we going to go?"

"You young men are going … down!" Newton says gleefully. "Choose your ride."

Kevin and Melbourne look in the direction that Newton points, and there are two more "vehicles" –two items with what look like seatbelts wrapped around them. One looks a LOT like a feather and one looks a lot like a bullet."

"We're supposed to ride… those?" Melbourne asks.

"I get the bullet," Melbourne shouts. "That's heavier, so it'll go faster!"

"Stupid. **We just proved** that everything falls at the same rate, no matter how much it weighs, so go ahead and take the bullet. It's not going to go any faster than the feather. The feather looks safer to me, anyway."

Galileo grins, "Ha ha! This young man has it figured out, no matter what an object weighs, it falls at the same speed as any other object. Not only am I brilliant, but I'm an excellent teacher, too."

"BUT!" says Newton, "We don't have free fall here on earth."

"Huh?" say Kevin, Melbourne, and Galileo in unison.

Newton sighs. "Goodness… Do I have to teach you EVERYTHING? Fine. Breathe."

Kevin, Melbourne, and Galileo breathe.

"And?" Asks Newton.

"And what?" asks Melbourne, getting a little tired of this Newton guy.

"And, you got something out of the air, right? Your lungs filled with something, right?"

"Yeah… so, what? Didn't you tell us to breath?" asks Kevin.

"Ok, ok…." Says Newton, "Here." Newton hands them all some glasses, "These, my friends are atom viewers… they won't be invented for another 2,000 years, but what the heck…"

Everyone puts the glasses on and SUDDENLY, atoms pop everywhere. They see oxygen atoms and water molecules floating in the air, they can see the teeny tiny atoms that make up their skin. They can see all of the atoms in the bullet and the feather.

"Whoa… this is like living in the matrix." Kevin says.

"It's like getting too close to the television," says Melbourne.

"Ok, ok… now, here's the point," says Newton, "Free fall, where everything falls at the same speed only happens in a vacuum[5] – which is a totally empty space.

You are not in a vacuum, you are surrounded by air and even though you can't SEE the air, the air is filled with tiny atoms and molecules. THOSE tiny atoms and molecules prevent all objects from falling at the same rate."

"Huh?" Kevin and Melbourne say together.

"Oh, just buckle in and let's go!"

The boys strap on their helmets and Melbourne sits on the bullet and puts on his seat belt. Kevin sits on the feather and puts on his seatbelt. Newton and Galileo give them each a shove and away they go.

"Whooo-hoooo," shouts Melbourne as he heads straight down. His bullet rockets to the ground, all of the atoms in the air sliding right along the bullet's smooth sides. Even when it hits an air molecule straight on, the nose of the bullet is pointy and the molecule slips right on past. It's like the best roller coaster ever – but he's heading for that bucket of pasta – and fast! CRASH!!!

Melbourne and his bullet create pasta sludge as they dive right to the bottom of the bucket. Melbourne has to use his swimming skills to dig his way up to the top of the pasta. Rubbing pasta out of his eyes and spitting out little bits of spaghetti, he looks around, "Where the heck is Kevin?"

Slowly, he can start to hear Kevin, although the sun is blinding him when he looks up, so he can't really see him, "Whoa! Hey! Ouch! Ugh… "

Kevin's feather slowly bumps and jumps downward, soaring from side to side and taking its time. With Kevin strapped on a flat side of the feather, it comes down flat side first and keeps running into thousands of air molecules. Each air molecule provides a tiny punch, holding Kevin up in the air. He bumps past one, and runs into the next one. He jiggles past a few particles, and runs into ten more. Together, the atoms push him horizontally almost as much as he's drifting downward.

Melbourne can see Kevin jerking and lurching…. Clearly this is no smooth ride for him.

"Ouch," thinks Melbourne, brushing more pasta sludge off of his shoes.

"Get me down!" cries Kevin.

"Hahahahahah!"

Melbourne, startled, turns around, but he knows that it's Newton behind him. "I knew it! Air resistance keeps things up in the air! The bigger the surface of the item, the more air molecules it runs into and the more it gets held up! The bullet goes fast because it is tiny and <u>streamlined</u> and the feather… well, the feather is still coming down."

Melbourne looks at Galileo, who is no longer dancing around, "It's ok, you know. It's not like you were totally wrong."

Review Questions:

1. Who interrupts Kevin, Melbourne, and Galileo's excitement about the bricks falling at the same speed?

2. Based on the passage what do you know about Newton?
    a. He's friends with Aristotle.
    b. He knows a lot about pasta.
    c. He's younger than Galilieo.
    d. He lives in Italy.

3. What about air causes things to fall at different speeds?

4. Why is Kevin's ride so slow and bumpy?
    a. Bullets are heavier so they fall faster than feathers.
    b. The feather is from a bird so it flies.
    c. The feather keeps hitting particles in the air and they slow him down.
    d. The atoms chase the feather and slow it down.

5. What is air resistance?
    a. The theory that feathers fall slowly.
    b. Air does not like it when things fall through it and it fights against those objects.
    c. Air creates free fall.
    d. Particles in air push upwards on falling objects and slow them down.

What do the following words mean *in the context of the passage*? (Words are underlined in the passage.)

6. Gleefully
    a. Singing
    b. Happily
    c. Meanly
    d. Sadly

7. Rate
    a. Speed
    b. Depth
    c. Score
    d. Density

8. Atom
    a. The smallest particle any element of matter.
    b. A type of physics.
    c. Small bacteria.
    d. A way to break things.

9. Vacuum
    a. A machine for cleaning.
    b. A type of broom.
    c. The air around the Tower of Pisa.
    d. A space that contains absolutely nothing, a void.

10. Streamlined
    a. Designed so that air or water can pass easily.
    b. Made of water.
    c. A large boat or ship.
    d. Designed to move at a steady pace.

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[4] **Sir Isaac Newton** (1643-1727) is credited with discovering gravity and air resistance. In many ways he was the father of modern science, especially physical science, developing laws of motion and force that we still use today. Folklore says that Newton watched an apple fall from a tree, and that's how he learned about gravity. In fact, he may have been inspired by the apple, but he already knew that gravity existed. What Newton was really trying to figure out was whether the earth's gravity was powerful enough to hold the moon in its orbit. But, that's another story.

[5] In physics, a **vacuum** is a space that is completely empty of matter. On Earth, even when an area looks empty, it usually contains air, which is matter. Scientists can create vacuums. This is how they test pure physics theories, like the theory of gravity. Scientists create a vacuum by sucking all of the air and other matter out of a space (with a super-high powered vacuum – like the vacuum you use to clean a carpet). Outer space, beyond the atmosphere is a vacuum (although there are probably no absolutely perfect vacuums). We can use vacuums to create suction (like a vacuum cleaner) because air wants to fill empty spaces, so if you create an empty space (for instance, inside the canister of a vacuum cleaner) other air will rush in to fill that space. We feel that as suction.

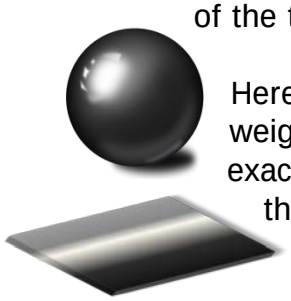
"Idongetit" Tales

Kevin and Melbourne Learn About … Air Resistance (again)

"Oh, I know I wasn't wrong, young man. And this young whipper-snapper…"

Melbourne pats him on the shoulder, "No, really, it's ok. People in a thousand years will remember you and all of your great discoveries. Newton really just built on what you did…"

Galileo will not be appeased; he wants a rematch. The moment Kevin lands, Galileo whips them both to the top of the tower.



"Ok, men, one more test. Here are two ten pound weights. They both weigh exactly 10 pounds, I tested them myself. But, they are different shapes. One is flattened into a huge sheet of metal. One shaped like a sphere. Let's make SURE that it's the shape that changes the speed. I mean, you can't assume Newton is right after that cockamaimy experiment – feathers fly, everyone knows that…."

Newton sputters, about to defend his experiment, but the boys, no longer afraid of diving off of the Leaning Tower of Pisa, run for their new vehicles.

"I get the round one this time! Cannonball, here I come. My butt can't handle any more bumps," Kevin shouts, strapping onto the round weight before Melbourne can stop him.

"Ok, fine," says Melbourne, getting on the sheet of metal.

Newton and Galileo give them each a shove off of the edge of the tower and away they go.

"Man, this IS fun!" Kevin shouts as he rockets towards the bucket of pasta. Because the cannonball is a sphere it slips right between the air molecules. He hits almost no air molecules and ones that he does hit slip right around the sides of the metal sphere, just like the bullet. "Sweet!"

Melbourne, on the other hand, gets battered. The sheet of metal is thin and wide, and it feels almost stuck on the air molecules. It's dropping, slowly, but it's also drifting. The air molecules are floating it like a paper airplane.

Kevin crashes down to the bottom of the pasta bucket. Melbourne doesn't hit for another 30 seconds… and even then he lands 3 feet away from the bucket, but he hits softly, almost like a hang glider landing, "Check it out – it really is the shape. Air resistance really works."

"Yeah, and no matter what their mass, all objects fall at the same rate!"

"Who –hoo! They do 'gitit!'" call Galileo and Newton. The vortex returns.

The next thing they know, Melbourne and Kevin are back at EdBoost, staring at their science homework.

"Oh no way…."

"What?" asks Kevin.

"The next question on my homework: what falls faster, a bullet or a feather, and why?"

"Well, we know that one." Kevin laughs and actually starts to do his work.

Review Questions:

1. How does Galileo feel about Newton proving him wrong?

2. Besides falling slowly, what else happens when Melbourne rides the metal sheet?
    a. He can control how fast he falls.
    b. He falls faster than the cannonball.
    c. He drifts around because the air moves him to the side.
    d. He has a very smooth ride down.

3. Why isn't Galileo convinced that shape affects how fast something falls after Newton's first experiment?

4. Which shapes are more streamlined?
    a. Bullets and feathers.
    b. Bullets and spheres.
    c. Feathers and sheets.
    d. Spheres and sheets.

5. What is the main factor that determines how much air resistance acts on a falling object?
    a. Who is riding the object that is falling.
    b. How streamlined an object is.
    c. The weight of the object
    d. What kind of weather it is and what the air is like.

What do the following words mean *in the context of the passage*? (Words are underlined in the passage.)

6. Appeased
    a. Made to feel better.
    b. Beaten, won against.
    c. Lulled into a false sense of security.
    d. Made more polite.

7. Sphere
    a. A flat piece of metal or plastic.
    b. A cylinder.
    c. A pyramid or three dimensional triangle.
    d. A three dimensional circle, like a ball.

8. Molecules
    a. Bursts of air.
    b. Small groups of atoms.
    c. Small birds.
    d. Pieces of brick and feather.

9. Battered
    a. Drummed for music.
    b. Held up, slowed down.
    c. Hit repeatedly, beaten.
    d. Floured for frying.

10. Drifting
    a. Floating, moving around slowly.
    b. Crying, sobbing.
    c. Wandering, walking without purpose.
    d. Dropping, falling.

Try it Yourself!

Do two pieces of matter, of exactly the same mass, really fall at different speeds depending on their shapes? Try it out!

1. Take two pieces of aluminum foil (or two pieces of paper). Hold them together and cut them to make sure that they are the exactly same size.
2. Crumble one piece into a tight ball. Leave the other as a sheet.
3. Stand on top of a chair, holding the ball in one hand and the sheet in the other (hold the flat piece so that the flat side faces the ground, like Melbourne's metal sheet).
4. Drop both pieces at the same time. Which one hits the ground first?