

These were prior Question of the Week questions on the Daytona Physics Tutor Facebook page. Enjoy.

9/24/14

Q.) This week's question:

What is the difference between a vector and a scalar?

A.) Last week's answer:

A vector has a magnitude and direction while a scalar is magnitude only.

9/10/14

Q.) This week's question:

If you have a cylinder that is 26 inches tall, and has a diameter of 8 inches, what is its volume in cubic feet?

A.) Last week's answer

That volume would be 0.76 ft^3

9/3/14

Q.) This week's question:

What does SOHCAHTOA mean?

A.) Last week's answer

It is how to remember the trig functions for right triangles. $\sin = \text{opp/hyp}$, $\cos = \text{adj/hyp}$, $\tan = \text{opp/adj}$

8/27/14

Q.) This week's question:

How many pounds is 15kg?

A.) Last week's answer:

If you multiply by an acceleration to get a force and then convert a kg is around 2.2lbs. So 15kg is 33lbs.

8/20/14

Q.) This week's question:

What happens when you ring out a soaking wet wash cloth in space?

A.) Last week's answer:

The water actually forms a tunnel around the cloth. A friend sent me this video from the ISS. Very cool. <http://apod.nasa.gov/apod/ap130424.html>

8/13/14

Q.) This week's question:

What is the difference between a mile and a nautical mile?

A.) Last week's answer:

A nautical mile takes the curvature of the Earth into account so it is a little bit longer 6076ft compared to 5280ft for a land mile.

6/11/14

Q.) This week's question:

How can someone lay on bed of nails without getting hurt?

A.) Last week's answer:

In this case Pressure is Weight divided by Area. All the nails added together gives an area that leads to a lower pressure so the nails do not puncture through the skin. Still, don't try this at home.....

6/4/14

Q.) This week's question:

We know that when things cool in temperature they contract. But we know water expands in volume when it goes from liquid to ice. Why?

A.) Last week's answer:

It is because when water goes from liquid to solid(ice) the density goes down so the volume has to go up for the same mass.

5/28/14

Q.) This week's question:

If we have $x^2 + 5x - 14 = 0$ what are the two values of x that satisfy the equation?

A.) Last week's answer:

Values for x that satisfy the equation are -7, 2

5/21/14

Q.) This week's question:

If we have a camera on the ground and it is 40m away from a 30m tall building, what is the angle of elevation if the camera looks at the top edge of the building?

A.) Last week's answer:

We know an opposite and an adjacent side of a right triangle so we use the tangent function. The angle is approx 37 degrees.

5/14/14

Q.) This week's question:

Why is the tide highest in both a new moon and a full moon?

A.) Last week's answer:

It is because the sun, moon, and earth are in a line so gravitational force is strongest.

4/30/14

Q.) This week's question:
What happens to a charge particle in a magnetic field?

A.) Last week's answer:
The particle will change its direction, but it will not change its speed.

4/24/14

Q.) This week's question:
If I have two dice 1-6 and I roll both at the same time, what is the probability I will roll a seven?

A.) Last week's answer:
The probability of a 7 is 6 out of 36 or 1/6. It is the most probable number of two dice.

4/8/14

Q.) This week's question:
Why is it easier to swing a larger diameter hula hoop?

A.) Last week's answer:
A bigger hoop has a large moment of inertia (how something spins) so it requires a smaller angular velocity (related to how fast it spins) to create the necessary angular momentum.

4/2/14

Q.) This week's question:
In chemistry does the percent composition of a compound depend on how much of the compound we have? In other words if I have 100 grams of salt is the percent composition of Sodium and Chloride different than if I have 500 grams of salt?

A.) Last week's answer:
The percent of each element is the same no matter how much of the compound you have.

3/27/14

Q.) This week's question:
If we turn on a light bulb on a pull cord in a house, like in a closet or garage or something, how many times a minute is the bulb off?

A.) Last week's answer:
Since our houses are AC at 60Hz this means the bulb is off two times a second. So, it is off for 120 times a minute. It just happens faster than we can see it. Yes, the right slow motion camera would catch it.

11/21/13

Q.) This week's question:
When we pull something like a cooked turkey from the oven and remove it from the external heat source how is carry over cooking possible?

A.) Last week's answer:

Since nature naturally moves from high temperature to low temperature it means that the surface of the turkey had to be at a much higher temperature so it could raise the internal temperature of the turkey.

11/13/13

Q.) This week's question:

I just saw a friend post it was -10 Celsius where they live. Brrrrr. What is that in Fahrenheit? What about in Kelvin?

A.) Last week's answer:

The Fahrenheit temperature is 14 degrees and the Kelvin scale temperature is 263.

11/6/13

Q.) This week's question:

If I am 100 meters away from a 50 meter tall building what is the angle between my feet and the top of the building?

A.) Last week's answer:

If we take the arc tangent function of $\frac{1}{2}$ we find 26.5 degrees

10/31/13

Happy Halloween everyone.

10/23/13

Q.) This week's question:

What is the difference between a scalar and a vector?

A.) Last week's answer:

A scalar has magnitude only. A vector has magnitude and direction. For instance speed which is a scalar may be 50 mph. Velocity which is a vector would be 50 mph south.

10/16/13

Q.) This week's question:

The class is calculus and the topic is derivatives. What rule is being used in the photo?

$f(x) = \sin^2(3x)$
 $f'(x) = ?$
 $u(x) = 3x \quad \frac{du}{dx} = 3$
 $h(u) = \sin(u) \quad \frac{dh}{du} = \cos(u)$
 $f(h) = h^2 \quad \frac{df}{dh} = 2h$
 $f'(x) = \frac{df}{dh} \cdot \frac{dh}{du} \cdot \frac{du}{dx}$
 $f'(x) = 6\sin(3x)\cos(3x)$

A.) Last week's answer:

Although many would like to call it the rule of confusion as Rich said come see DPT and you'll understand that it is the chain rule.

10/9/13

Q.) This week's question:

I have a brass ring and put it in a fire to raise the temperature. We know the outer diameter increases. Does the inner diameter (increase, remain the same, decrease)?

A.) Last week's answer:

The inner diameter increases.

10/2/13:

Q.) This week's question:

Does it take more energy to turn 1kg of water to steam or raise the temperature of 1kg of water from 1 to 100 degrees Celsius?

A.) Last week's answer:

State changes require a large amount of energy. So going from water to steam at 100 degrees C takes more than raising the temperature of water from 0 to 100 degrees C.

9/18/13

Q.) This week's question:

Amazing! A man made object, Voyager I, has reached interstellar space. What two planets did Voyager I explorer on its already long but many years and miles to go journey?

A.) Last week's answer:

Voyager I explored Saturn and Jupiter on it's way to interstellar space.

9/4/13

Q.) This week's question:

What is the applied version of Ohm's law?

A.) Last week's answer:

We use Ohm's law in the form of Voltage = Current x Resistance i.e. $V=IR$

8/28/13

Q.)

A 0.4kg baseball thrown is thrown at 35m/s (77miles/hr) and a 0.005kg bullet is fired at 300 m/s (660 miles/hr). Which has more kinetic energy?

A.)

If we use our formula for kinetic energy $\frac{1}{2}mv^2$ the bullet has 225J of energy while the baseball has 245J of energy.

8/21/13

Q.)

If something is moving in a circle in what direction is the centripetal force always?

A.)

Centripetal force is always toward the center. When that force is no longer there the object moves in a straight line which looks like it is going "out" to the person standing at the center of the circle.

8/7/13

Q.)

The type of bonding in NaCl (salt) is _____ (covalent/ ionic/ magic)?

A.)

It is ionic. Although many students think it is magic.

7/31/13

Q.)

Floating in this cup filled with water is a rock. Can you identify the type of rock? How can a rock float?



A.)
It is pumice. It floats because of Archimedes principal.

7/24/13

Q.)
We know that in a vacuum the speed at which an object falls is independent of mass. Is the force on a falling object independent of mass? Is the energy of a falling object independent of mass?

A.)
Both the force and the energy are dependent on mass.

6/26/13

Q.)
Which uses more energy: A 1200 Watt hairdryer running for 5 minutes or a 60 Watt light bulb running for one hour?

A.)
In the metric system a Watt is energy/second and the energy has units of Joules. So the hairdryer uses 360,000 Joules while the bulb uses 216,000 J. The hairdryer is more.

6/19/13

Q.)
(True or False) If I have a car moving at 20mph North and 30mph East, the car is moving at 50mph NE.

A.)
These are vector components so we have to use trigonometry and we find the car is moving 36 mph at 34 degrees north of east.

6/13/13

Q.)
List in order from longest to shortest wavelength, the colors of the visible part of the spectrum?
(Hint: Red is first)

A.)

Red, Orange, Yellow, Green, Blue, Indigo, Violet. Also know as my buddy Roy G. Biv, the colors we see in a rainbow.

6/5/13

Q.)

We know that if an object is in free fall it is accelerating at 9.8m/s^2 . What is the dependence on an angle if the object is sliding down an incline? Ignoring friction for both cases....

A.)

We have to involve trigonometry with the sin function which has a max of 1 and a min of -1. The answer is acceleration = $9.8\sin(\text{angle})$

5/29/13

Q.)

How much of the volume of an iceberg that is floating in the ocean is below the surface?

A.)

If we go through the process it turns out to be the ratio of the density of ice 920kg/m^3 to seawater 1030kg/m^3 so approx 90%

5/22/13

Q.)

What is the sum of all integers from 1 to 100?

A.)

This is an arithmetic series and the answer is 5,050.

5/16/13

Q.)

A person saves a king's life. The king says I'll give you a reward. The person says I want you to start with one grain of rice, then each day double what you gave me the day before for 30 days. (i.e. for four days, 1, 2, 4, 8) How many grains of rice does the king end up giving?

A.)

This is called a geometric series and for its formula with a ratio of 2 and 30 days the total is 37,025,580 grains of rice.

5/8/13

Q.)

Why is the first hill (the one a chain pulls the carts up) of a roller coaster the tallest?

A.)

Since energy is conserved we could not go any higher than we start unless we have something else push us. A roller coaster of course does not have anything pushing the carts after the first hill. Since we are losing to friction the hills become smaller.

5/1/13

Q.)

Why can we truly never reach the temperature of absolute zero?

A.)

Absolute zero would mean no motion at all even on a subatomic level. This would violate some principles of quantum mechanics.

4/3/13

Q.)

Why is it harder to get an object moving than to keep the same object moving? (Hint: Inertia is not the answer.)

A.)

On a microscopic level even smooth surfaces are very rough. All the nooks and crannies somewhat lock together and the initial force also has to overcome this. After that the surfaces more ride on top of each other so it takes less to keep an object moving.

3/27/13

Q.)

Is the Earth's magnetic south pole closer to the Earth's geographic north (the Arctic) or south pole (Antarctica)?

A.)

This one can be confusing. The Earth's magnetic south pole is actually about 11 degrees off line with Earth's geographic north pole. From convention though many people are calling magnetic north what is in line with the Earth's south magnetic pole. Incorrect but helps when giving directions to have "North" coincide with the north geographic pole.

3/20/13

Q.)

On a warm, humid day, how does condensation occur on your cold glass of water?

A.)

When there is enough moisture in the air and a big enough "local" temperature difference, the thermal energy transfers from the water vapor to the glass. When enough is transferred then droplets form. It's the same as when the windows in the house or mirror near the shower have water droplets from on them.

3/13/13

Q.)

True or False, The SR-71 Blackbird aircraft would leak fuel when sitting on the ground?

A.)

True. As the plane flies it heats which causes expansion and seals the leaks.

3/6/13

Q.)

The space station has a speed of 7710 m/s at a height on average of 6.78×10^6 m above the center of the Earth. How many trips around the Earth does it make in one day?

A.)

The orbital period for the space station is around 92 minutes. That means it makes around 15.6 trips around the Earth in one day.

2/27/13

Q.)

What are the lightest and heaviest known natural elements?

A.)

The lightest is hydrogen, the heaviest is uranium.

2/20/13

Q.)

What causes the Aurora Borealis?

A.)

Besides light, the sun emits many high energy charged particles. Some get trapped in the Earth's magnetic field and follow the field lines toward the poles of the planet. There they interact with elements in the Earth's atmosphere and cause the Northern Lights.

2/13/13

Q.)

We know that Pi, 3.1415..... is significant. But what is it?

A.)

Pi is the ratio between the circumference of a circle to its diameter. To put it another way, a trip around the outside of any circle is 3.14.... times longer than walking across the middle.

2/6/13

Q.)

Is $2(x+3)^2$ equal to $(2x+6)^2$? The 2 means squared.

A.)

They are not equal. Even though it looks like we could distribute the 2, we can't since the quantity is squared.

1/30/13

Q.)

If we look to the stars we know we can see the light coming toward us. What is the best example of seeing light as it is coming from a star “behind” us?

A.)

Since the sun is behind us at night, seeing the light reflect off the moon for phases other than new moon is the best example. Thanks to Rich for the question.

1/23/13

Q.)

Is air a fluid?

A.) Yes it is. Many times in science the details of a definition are different than we use in everyday lingo. Since liquids and gases have some things we treat in the same manner, the general term is fluids.

1/16/13

Q.)

Which has the highest temperature, which has highest energy: Orange flame or Blue Flame?

A.)

The higher temperature is the blue flame. Since temperature corresponds with energy, the higher energy is also the blue flame.

1/9/13

Q.) Friends of mine told me of similar questions which generated a good discussion. You have $8/2(1+3)=?$ Is this equal to 16 or 1?

A.)

This one is messy. Did the author mean $[8(1+3)]/2 = 16$ or $8/[2(1+3)] = 1$? In fact if you put the original in different calculators and software some will return 16 and some will return 1. People in mathematics use the convention that numbers next parenthesis are multiplied by each other so $8/[2(1+3)] = 1$.

12/5

Q.)

When you have a tire gauge and it reads 35 psi, is that the total pressure?

A.)

No, that is actually the gauge pressure which does not include the 14.7 psi for atmosphere. So the total pressure is 49.7 psi.

11/28

Q.)

If you have a pendulum clock and you increase the mass at the bottom of the pendulum would the clock run (slower, the same, faster)?

A.)

The clock will run the same. The period of a pendulum is independent of the mass at the end of the pendulum.

11/21

Q.)

I think this one fits for Thanksgiving week. (True or False), A Microwave cooks from the inside out.

A.)

False. Microwaves are light so they transfer energy. The food absorbs the energy and the microwaves do penetrate to get to the inside quicker but it still happens from the outside in so to speak.

11/13

Q.)

There is a clearly a mathematical error in the following. Can you find it?

Let $a=b$

$aa = ab$ (multiply each side by a)

$aa + aa = aa + ab$ (add aa to both sides)

$2aa = aa + ab$

$2aa - 2ab = aa + ab - 2ab$

$2aa - 2ab = aa - ab$

$2(aa - ab) = 1(aa - ab)$

dividing by $(aa - ab)$ gives

$2 = 1$

A.)

Since $a=b$ then $aa-ab$ is actually 0. The last step is trying to divide by zero which is not mathematically allowed. So we're safe. 2 does not equal 1. Thanks to Scooter for the question.

11/6

Q.)

How does a tuning fork work?

A.)

As the tuning fork tines moves in and out they compresses and then allow the air to expand. This change in pressure propagates out as sound. Since the fork is moving back and forth at a constant rate you get a certain frequency.

10/30

Q.)

Danielle purchased a new travel thermos to keep her hot drinks hot and her cold drinks cold. How is it possible for one container to do this?

A.)

A thermos has an outer container and an inner container which are attached by a very small amount. A vacuum has been applied so there is no air in between the two containers. Thermal energy transfer (which will change the temperature) is done in three ways. With the vacuum and the small amount for conduction we have minimized the thermal energy transfer.

10/16

Q.)

You are standing at the edge of a pond looking at an angle down into the water and see fish. Are the fish (closer than you see them, where you see them, farther than you see them)?

A.)

The fish are closer than they appear. The light refracts (bends) when it passes from the water to the air. In this case it bends toward the water. A loose visual is this. Think of a drinking straw with a bend in it. You “see” the fish as if you looked back through the straw above the bend. The fish are actually closer to if you looked down the straw after the bend.

The following are not dated.....

Q.)

Throw a ball up what are v, a at the turning point.

A.)

We need to remember that acceleration is the rate of change of velocity with respect to time. Near the surface of the Earth acceleration due to gravity is approximately a constant 9.8 m/sec^2 . This means the velocity of the ball is continually changing at a constant rate. Even though $v = 0 \text{ m/sec}$ at the maximum height, the acceleration at any point of the trajectory including the maximum height will still be 9.8 m/sec^2 toward the Earth!

Q.)

You put some ice in a cup of water. Does the ice cool the water or does the water warm the ice?

A.)

The water warms the ice. In nature temperature or thermal energy, “flows” from hot to cold. So even though the temperature of the water drops, it is actually due to the water transferring thermal energy to the ice.

Q.)

As it is the opening to baseball season, let’s see how much time a hitter has to react. My favorite player, HOF pitcher Nolan Ryan, has a pitch leave his hand 56 feet from home plate. The average speed of that pitch we’ll take to be 100 mph. What is the time to home plate? Remember average speed is distance/time. Useful conversions: 1 mile = 5280 ft. 1 hour = 3600 seconds.

A.)

The pitch would take around 0.38 seconds to reach home plate. That's a small amount of time to determine what type of pitch, location, and movement. 5714 strike outs later, with 839 more than second place, it's easy to see was a first ballot Hall of Fame inductee.

Q.)

100 years ago on April 15, the Titanic sank. To see how water and ice, which we can easily hold in our hand were such a problem, do a quick calculation. Take a room sized volume, 5meters by 3meters by 2.5meters and find it's mass and weight. Numbers needed, Density of ice is 920 kg/cubic meter. Density of sea water is 1030 kg/cubic meter. 1kg leads to 2.2 lbs at sea level.

A.)

A room size volume of 37.5 cubic meters of ice has a mass of 34500 kg leading to a weight at sea level of 38 *tons*. Now imagine how much mass an iceberg has as compared to a living room size chunk! It's true the weight of the iceberg is supported by the buoyant force as that is how it floats. However, the mass is a **very** important item in collisions. By the way, the same living room size volume of sea water has a mass of 38600 kg leading to 42.5 *tons*. Now it's easy to see how water and ice which are essential to our survival can also be so powerful.

Q.)

Sound waves require a medium through which they can propagate. In other words sound waves have to go through a substance and this can include gases such as air. Sound travels at different speeds through different mediums. Place the three mediums in order from fastest to slowest for the speed of sound: Air (at room temp), Steel, Water.

A.)

Speed of sound for mediums from fastest to slowest: Steel 5000 m/s, Water (room temp) 1482 m/s, Air (room temp) 344 m/s.

Q.)

The speed of light is calculated by multiplying (frequency) by (wavelength). In a vacuum this is around 186,000 miles/sec. In a medium (air, water, glass, etc...) which if any, of speed, frequency, or wavelength change?

A.)

Although the frequency of the light remains the same, the wavelength and the speed both change.

Q.)

True or False: Air resistance is dependent on the mass of an object?

A.)

False. It is dependent on surface area. I appreciate the interactions and shape is very close so you were headed in the correct direction!

Q.)

This question was selected after a lively response this morning.... You hold a gun parallel to the ground and pull the trigger. As the bullet leaves the gun barrel you drop another bullet from your hand so both the fired and dropped bullet leave from the same height. Is the time for the fired bullet (*more, same as, less*) than the time for the dropped bullet to hit the ground? Ignore air resistance, etc...

A.)

The time is the same. The vertical and horizontal are independent of each other. So the same acceleration due to gravity acting over the same vertical distance means the same time. Even in a non-ideal environment the time is very, very, close. Dougie suggested this question a couple months ago and it is a good one. Thanks for the posts and more are welcome to interact.

Q.)

You have two identical chunks of ice. Same mass, shape, temp, etc... You put one in a 225 degree Fahrenheit oven and the other in a bowl with 60 degree Fahrenheit running water. Which melts first and more important why?

A.)

Yes, it is the running water. One of the main ways of thermal energy transfer (which loosely means changing temperature) is conduction. Since water is around 833 times more dense than air, this means there are considerably more water molecules in contact with the ice. The result is that the water will transfer more thermal energy through molecular collisions than the air does in the same amount of time. It's true the air molecules in the oven have more thermal energy but there are far fewer collisions so it takes longer.

Q.)

Let's do a bit of applied math. The radius of a golf ball is approx 0.84 inches. How far does a golf ball travel in one revolution? Also, how many revolutions does a golf ball make in a three foot putt? Ignore slipping, friction, slope, etc ...

A.)

5.3 inches, 6.2 revolutions. One revolution would be the circumference which equals $3.14 \times \text{Diameter}$. Then the number of revolutions is $36 \text{ inches} / 5.3 \text{ inches} = 6.8 \text{ rev}$.

Q.)

We've all seen the video of a nice table setting and someone pulls the table cloth very quickly and the place settings remain without falling. Besides speed, what is the other important factor in pulling the cloth and why?

A.)

You have to pull very close to horizontal. Any kind of sizable vertical component causes disaster. As a follow up, our goal is to overcome the static frictional force between the objects and cloth and create slipping. This is all in the horizontal. Starting from rest the building force to do this will act over time, in this case a small time, and essentially everything will move toward the direction of the moving cloth until things slip. Then kinetic friction will act to slow and stop the items.

Q.)

True or False: Radio waves are light.

A.)

True. Although most think of the visible part of the spectrum when we say light, radio waves are light. Radio waves have longer wavelengths and lower energy than visible light but they are an oscillating electric and magnetic field. In truth, visible light is only a small part of the spectrum.

Q.)

I'm floating in the water next to a small boat that has 10 times my mass. I push on the boat. The boat moves to the left and I move to the right. Compare the force on myself and the boat. Compare the acceleration of myself and the boat.

A.)

From Newton's third law the forces are equal in magnitude and opposite in direction. One force acting on me while the other force acts on the boat. Because the mass of the boat is 10 times my mass, using Newton's second law (net force equals mass x acceleration), my acceleration is 10 times greater than the acceleration of the boat.

Q.)

For the fourth of July let's do a thought experiment. We'll pretend we are on the space station and we have a special firework that has a canister of oxygen so that combustion of the fuse and the powder is possible. The firework is held outside in the vacuum of space. We light the fuse and it launches away from us. What will be different when it explodes as opposed to if it was on Earth?

A.)

With no atmosphere several things would be different. There would be no sound and no shock wave. The pattern would look different after the explosion. Most fireworks down here have that nice sphere because they seem to detonate at their highest point. In this case the gravitational force is cancelled so actually our firework would continue to accelerate and go faster and faster away from us before it detonated. We would only see a flash anyway because after the explosion there would be no oxygen to sustain combustion so we wouldn't see the embers glowing so no awwwww moment.

Q.)

In a right triangle (one angle is 90 degrees) we know the hypotenuse is the longest side. That length is (*more than, equal to, less than*) the sum of the lengths of the other two sides. Pick the correct one.

A.)

Less than (always by the way). If you would like a quick example think of a baseball diamond. If we run from home plate down to first base (90 ft) then turn 90 degrees and run from first to second base (90 ft) we have run 180 ft. Now instead run from home plate to second base directly over the pitcher's mound. This route would be the hypotenuse of a right triangle (the first base

line and second base path are at 90 degrees). The path over the pitcher's mound is 127 ft, clearly less than the prior sum of 180 ft.

Q.)

I hear questions on this concept often. You are in a plane flying from Daytona to Atlanta at 450 miles per hour. You stand in the aisle and jump up. Why is it you land on the same patch of floor you jumped from instead of slamming into the back of the plane?

A.)

To start with you and the plane are both moving at 450 mph. When you jump you jump in the vertical direction which has no effect on the horizontal 450 mph. Even when you are in the air, nothing has slowed you and you still maintain your 450 mph horizontal. Since you and the plane are still both moving 450 mph you both travel the same horizontal distance which means you land in the same place.

Q.)

A light year measures (time, distance, or velocity)? Also what is the value?

A.)

It is a ... Distance! It is the distance light would travel in one year, approximately 5900000000000 miles.

Q.)

We know the Earth revolves around the sun (approx 1 year) and rotates around it's axis (approx 1 day). We also know the moon revolves around the Earth (approx a month). Does the moon rotate around it's axis? How can you tell if it does or not?

A.)

Yes it does. It rotates around its axis the same rate it revolves around the Earth, approx 27 days. We know because we always see the same side. If the moon didn't rotate around it's axis we would see the other side of the moon.

Q.)

As there are so many summer showers right now... Why is it that we sometimes see two rainbows instead of one?

A.)

As white light enters a drop of water it refracts and splits into the colors of the spectrum. These separate colors of light pass through the back of the drop and we see our first rainbow. However, while most of the light passed through the back of the drop some light reflects and now passes through the front of the drop. So, we see a second, faint, rainbow. By the way, this cycle keeps happening we just don't see the other rainbows because they are very faint.

Q.)

Along the line of storms... What causes the thunder we hear in a lightning storm?

A.)

There seems to be some debate about this one in various circles. But in general when lightning occurs the air around the lightning bolt goes through tremendous temperature changes, up to near 50,000 degrees Fahrenheit. This creates changes in pressure that lead to the air expanding and contracting. The resulting shockwaves from these pressure changes are what we hear as thunder.

Q.)

This was a lead into a TV show and I thought it was good. What element do we mine from the Earth, forge for buildings, eat, etc.... Hint: it is the most common element forming the Earth?

A.)

Iron is correct.

Q.) This week's question:

If you have a circular pipe that is five inches in outer diameter and four inches in inner diameter what is the thickness of the pipe? Also, what is the area of the inner opening?

A.)

Since the diameter is a straight line across the pipe it includes two sides of pipe. Take the difference in diameter and divide by 2. So the thickness is $\frac{1}{2}$ inch. The area is either $\text{Pi} \cdot \text{radius}^2$ or $\text{Pi}/4 \cdot \text{diameter}^2$. Which leads to an area of 4π or approximately 12.5 square inches.

Q.)

Although there were people who developed parts prior to him, Thomas Edison made the complete system and is credited as the "inventor" of the light bulb. What material did he use as the filament for the bulb in his system that was so successful?

A.)

Although he tried several, the filament for the sustainable successful system was made of Carbon.

Q.)

I did not think before to ask this one. So, in honor of Neil Armstrong... If the moon is an average of 238,855 miles away and light moves at 186,282 miles per second, approximately how much time passed between Neil finishing his famous quote and hearing a response from Mission Control? You can ignore any effect from passing through the atmosphere of the Earth or delays in electronics.

A.)

Radio waves are light and $\text{Time} = \text{distance}/\text{speed}$ so it takes 1.3 seconds each way between the moon and the Earth. So it takes approximately 2.6 seconds round trip for radio messages ignoring the time of speaking.

Q.)

Here is a conversion question. How many 8oz cups are in a Pint, a Quart, and a Gallon?

A.)

2 cups in a pint, 4 cups in a quart, 16 cups in a 128oz gallon.

Q.)

An incandescent bulb when plugged into an AC outlet actually flashes. It happens at a rate we can't see, but let's imagine we could. If a bulb is plugged into a socket in America, an Alternating Current (AC) which is 60Hz, how many flashes would we see? How about in Europe where it is a 50Hz AC outlet? By the way Hz means Hertz, cycles per second...

A.)

120 flashes in a second or 100 flashes in Europe. With it being AC that means in one cycle it will go from 0 volts to maximum positive voltage back to 0 volts then to maximum negative voltage then back to 0 volts which is also the starting point for the next cycle. So, we would see two 0 voltages, or offs, or flashes, per cycle. At 60 cycles per second and 2 blinks per cycle is our 120 flashes.

Q.)

Why does a carbonated soda "fizz" when you open it but not when it is sitting on the shelf?

A.)

There is carbon dioxide gas in the soda. Since the can is under pressure, (around 40psi according to soda manufacturers) the CO₂ gas is essentially suspended in the soda. When we open the top since our normal atmospheric pressure is around 14.7 psi the CO₂ is allowed to escape from the soda. The escaping bubbles bring little bits of soda with them which is the fizz. Thanks for the comments and to Rich P for the question.

Q.)

Why does a "curve" ball curve when it is in mid-air?

A.)

The spin combined with drag creates turbulence. This leads to a pressure difference leaving a net force which moves the ball in the direction of the lower pressure. Thanks to Rich P for the question.