Center City Public Charter Schools
Character, Excellence, Service

7th Grade Science
Academic Readiness for 2020

Dear Center City Families,

In this challenging time, Center City staff is doing our best to ensure that your child is academically prepared to return to school in the Fall of 2020 with minimal learning loss. We have created this packet of academic materials that expand on foundational content that was covered this school year. Your child should complete this work to be ready for school once the academic year starts again in the fall.

This packet includes approximately four weeks of work. **Between May 4th and 22nd, teachers will schedule virtual check-ins with students centered around the content of this packet. Please return the completed packet to your home campus no later than June 5, 2020.**

Inside this packet, you will find:

- A table of contents that shows page numbers for each included activity
- A calendar that shows, day by day, which activities students should complete
- A copy of every activity and assignment that students will need to complete

Your child's teachers will be reaching out via text, email, phone, or Class Dojo to let you know when they are available and how they will monitor student progress on academic work through May 22nd.

There are a number of ways you can support the academic growth of your child during this time and throughout the summer:

- If possible, provide them with a quiet, comfortable place in which to complete their work.
- Please encourage them to read a book or magazine for pleasure. You can find books and resources online at www.dclibrary.org.
- Encourage children to keep a diary or journal for recording their thoughts, observations, or drawings.
- Get outside for an hour or two as weather permits.
- Reach out to the teacher if your child has any questions about the work in this packet.

We thank you for your patience and flexibility during these unprecedented times. If you have any questions or concerns, please do not hesitate to reach out to your campus team. In the meantime, we encourage everyone to stay safe and healthy by following the social distancing protocols that Mayor Bowser has put into place.

Sincerely,

The Center City Team

7th Grade Science
Preparación Académica para 2020

Queridas Familias de Center City,

Durante este tiempo difícil, el personal de Center City está haciendo nuestro mejor para asegurar que su hijo está académicamente preparado para regresar a la escuela en el otoño de 2020 con una pérdida mínima de aprendizaje. Hemos creado este paquete de materiales académicos que amplían en el contenido fundacional que estaba cubierto este año escolar. Su hijo debe cumplir este trabajo para estar listo una vez el año académico empiece otra vez en el otoño.

Este paquete incluye aproximadamente cuatro semanas de trabajo. **Entre el 4 y el 22 de mayo, los maestros van a programar conversaciones virtuales con los estudiantes para hablar sobre el contenido de este paquete. Por favor entreguen el paquete cumplido a su campus no más tarde que el 5 de junio, 2020**.

Adentro este paquete, van a encontrar:

- Una tabla de contenido que muestra el número de página para cada actividad incluida
- Un calendario que muestra, día por día, cuáles actividades los estudiantes deben cumplir
- Una copia de cada actividad y trabajo que los estudiantes necesitan cumplir

Los maestros de su hijo van a estar en contacto por texto, correo electronico, telefono, o Class Dojo para notificarles cuando están disponibles y cómo van a monitorizar el progreso de su estudiante en el trabajo académico hasta el 22 de mayo.

Hay una variedad de maneras que usted puede apoyar el crecimiento académico de su hijo durante este tiempo y durante el verano:

- Si posible, proporcione su estudiante un lugar tranquilo y cómodo donde puede cumplir su trabajo.
- Por favor anímalo a leer un libro o revista para diversión. Puede encontrar libros y recursos en línea a www.dclibrary.org.
- Anime los niños a escribir un diario con sus pensamientos, observaciones, o dibujos.
- Salgan afuera por una hora o dos si el tiempo lo permite
- Hable con el maestro si su hijo tiene alguna pregunta sobre el trabajo en este paquete.

Les agradecemos su paciencia y flexibilidad durante esta época sin precedentes. Si tiene preguntas o preocupaciones, por favor no duden en ponerse en contacto con el equipo de su campus. Mientras tanto, animamos a todos a mantenerse seguros y saludables por seguir los protocolos de distanciamiento social que la alcaldesa Bowser ha implementado.

Sinceramente,

El Equipo de Center City

Center City Public Charter Schools
Character, Excellence, Service

ትምህርታዊ ዝግጁነት ለ 2020 7th Grade Science

የተከበራችሁ የሴንተር ሲቲ ወላጆች

በዚህ ፈታኝ መቅት የሴንተር ሲቲ ሰራተኞች ልጅዎ በ 2020 መገባደጃ ላይ ወደ ት / ቤት ሲመለስ በትምህርቱ ዝግጁ መሆኑን ለማረጋገጥ የተቻለንን ሁሉ እያደረጉ ነው ። በዚህ የትምህርት ዓመት የተሸፈኑ መሠረታዊ ይዘቶች ላይ የሚያተኩር ይህንን የትምህርት ቁሳቁስ የያዘ ፓኬጅ ፈጥረናል ። የትምህርት ዓመቱ በበልግ መቅት/ፎል እንደገና ከተጀመረ ልጅዎ ለትምህርት ቤት ዝግጁ ለመሆን ይህንን ስራ መሙላት/መስራት አለበት።

ይህ ፓኬት በግምት የአራት ሳምንታት ሥራን ያካትታል ። ከግንቦት/ሚይ 4 እስከ 22 ኛው ባለው ጊዜ መምህራን በዚህ ፓኬጅ ይዘት ዙሪያ እተኩረው ከተማሪዎች ጋር በቨርቹዋል/በኢንተርንት ለሚደረግ ትምህርት መርሃ ግብር ያዘጋጃሉ ። እባክዎን የተጠናቀቀውን እሽግ ከጁን 5 2020 ዓ.ም. በፊት ወደ ትምህርት ጣቢያ/ ካምፓስ ይመልሱ ።

በዚህ እሽግ ውስጥ የሚከተሉትን ያገኛሉ፡

- ለእያንዳንዱ ስራዎች የገጽ ቁጥሮችን የሚያሳይ የይዘት ሠንጠረዥ
- ተማሪዎች በየቀኑ ማጠናቀቅ የሚጠበቅባቸውን ስራዎች የሚያሳይ የቀን መቁጠሪያ
- ተማሪዎች ማጠናቀቅ የሚያስፈልጓቸውን የእያንዳንዱ እንቅስቃሴ ቅጅ/ኮፒ

የልጅዎ አስተማሪዎች እስከ ሜይ 22 ባለው ግዚ መቼ እንደሚገኙ እና እንዴት በአካዳሚክ ሥራ ላይ የተማሪዎን እድገት እንዴት እንደሚቆጣጠሩ ለማሳወቅ በጽሑፍ ፣ በኢሜል ፣ በስልክ ወይም በክፍል ዶጆ/ በኩል ለማድረስ ጥረት ያደርጋሉ ።

በአሁኑ ሰአት እንዲሁም እስከ ሰመር ባለው ጊዜ የልጅዎን የትምህርት እድገት ለመደገፍ በርካታ መንገዶች አሉ፡

- የሚቻል ከሆነ ሥራቸውን የሚያጠናቅቁበት ጸጥተኛና ምቹ የሆነ ቦታ አዘጋጁላቸው።
- እባክዎን ለመደሰት መፅሃፍ ወይም መጽሔትን እንዲያነቡ ያበረታቷቸው ። መጽሐፍትን እና የተለያዩ ጽሁፎችን በ www.dclibrary.org ማግኘት ይችላሉ ።
- ሀሳቦቻቸውን ፡ ምልከታዎቻቸውን ፣ ወይም ስዕሎቻቸውን ለመገልበጥ ልጆች ማስታወሻ ደብተር ወይም ማስታወሻ እንዲይዙ ያበረታቷቸው።
- የአየር ሁኔታ እንደሚፈቅድ ለአንድ ወይም ለሁለት ሰዓት ወደ ደጅ የዘዋቸው ይውጡ ።
- ልጅዎ በዚህ ፓኬት ውስጥ ስላለው ሥራ ጥያቄ ካለዎት ከአስተማሪው ጋር ይገናኙ ።

በእነዚህ ባልተለመዱ ጊዜያት ስለትዕግስትዎ እና እናመሰግናለን ። ማናቸውም ጥያቄዎች ወይም ስጋቶች ካሉዎት እባክዎን ወደ የካምፓስ ቡድንዎን ለመገናኘት አያመንቱ ። ይህ በእንዲህ እንዳለ ከንቲባ ባውዘር ያስቀመጠቻቸውን ማህበራዊ ልዩነትን /ተራርቆ የመቆየት ፕሮቶኮሎችን በመከተል ሁሉም ሰው ደህንነቱ የተጠበቀ እና ጤናማ ሆኖ እንዲቆይ እናበረታታለን ።

ከሠላምታ ጋር ፡

የሴንተር ሲቲ ቡድን

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6th, 7th, and 8th Grade Science

May Academic Readiness Packet

Each week, you will complete lessons that align to one Focus Question. All of the lessons are based on content that we have already learned in our Science class. You should spend between 45-60 minutes on each daily lesson. If you need help, reach out to your Science teacher!

Week	Content	Focus Question	Pages
1	Heredity and Adaptations	Why does sexual reproduction result in offspring with genetic variation	1-13
2	Electromagnetic Forces	How are electricity and magnetism related?	15-28
3	Gravity and Kinetic Energy	How does the Law of Inertia apply to the real world?	29-37
4	Waves	What are the basic parts and characteristics of a wave?	39-48

HEREDITY AND ADAPTATION

Week of: May 4				
Focus Question: Why does sexual reproduction result in offspring with genetic variation?				
Monday- Engage	Tuesday- Explore	Wednesday- Explain	Thursday- Elaborate	Friday- Evaluate
On Monday, you are going to ... -Match celebrity parents with their offspring.	On Tuesday, you are going to ... -Complete a genetics lab.	On Wednesday, you are going to ... -Write an explanation about how parents pass traits to offspring.	On Thursday, you are going to ... -Read about genetics.	On Friday, you are going to ... -Write an explanation, using Claim, Evidence and Reasoning to answer the Focus Question.

MONDAY- Engage

Look at the pictures and try to match the celebrity offspring to the celebrity parent. Draw a line to connect.

Answer the following questions:

1. Explain what your thought process was as you were matching the celebrities to their offspring.

2. What does this have to do with genetics?

Complete the first two boxes in the KWL chart:

What I already **know** about this topic:	What I **want** to know about this topic:	What I have **learned** about this topic:

TUESDAY- Explore

Below there are two sets of instructions for how to set up your exploration activity. Follow the set-up instructions using whatever materials you have at home.

Option 1: (Colored Pasta)

Materials
4 bags pasta of different shapes
4 small vials food coloring: red, blue, green, and yellow
White vinegar (inexpensive brand)
Paper muffin cups

Preparation
Use four distinctly shaped dried pastas. Examples: wagon wheels, shells, fusilli (snakes), and macaroni. Dye one quarter of each shape red, green, yellow, or blue using the following easy procedure.

Place one half gallon vinegar and one small vial food coloring in a large bowl. Stir to mix. Place one quarter of each of the 4 bags of pasta in each bowl. Stir well. Let pasta sit in dye-vinegar mixture for one hour, stirring occasionally. Drain pasta and rinse briefly in cold water. Note: if you do not rinse the pasta, it will remain very aromatic. If you rinse too vigorously or for too long, some of the color may leach out. Cover cookie sheet with foil and place dyed pasta on top in single layer. Bake in 250° oven for 10 minutes to dry the pasta.

To carry out the activity, set up the following materials:
7 paper muffin cups
8 red pasta shapes (2 of each shape)
8 green pasta shapes (2 of each shape)
8 yellow pasta shapes (2 of each shape)
8 blue pasta shapes (2 of each shape)

Option 2: (Paper Shapes)

Materials
4 pieces of paper in different colors
Scissors
Paper muffin cups

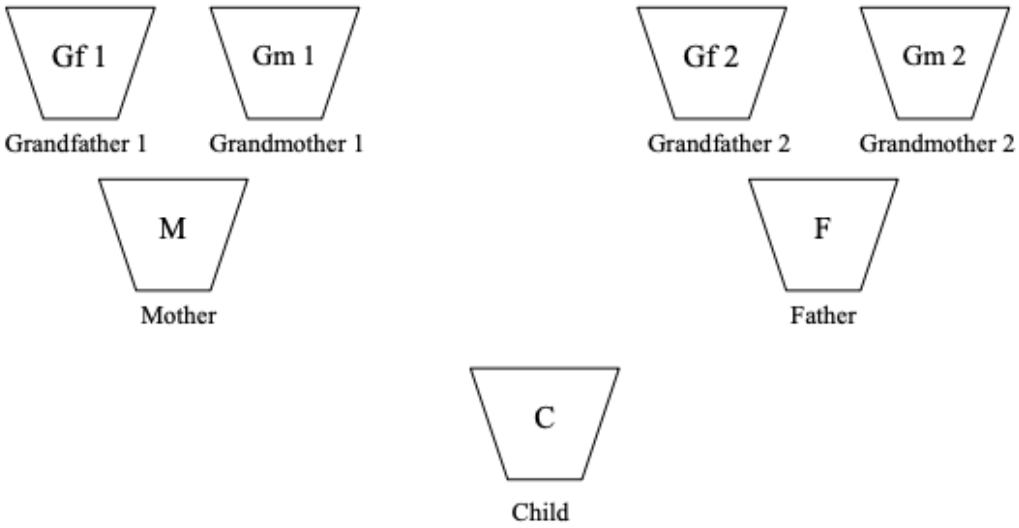
Preparation
Using your scissors, cut each piece of colored paper into 4 different shapes (two of each: triangle, circle, square, heart)

To carry out the activity, set up the following materials:
7 paper muffin cups
8 red pasta shapes (2 of each shape)
8 green pasta shapes (2 of each shape)
8 yellow pasta shapes (2 of each shape)
8 blue pasta shapes (2 of each shape)

Student Directions Pasta Genetics

This activity will show you how genes, the directions for building a person, are passed from grandparents to parents to children and why each of us is unique. (If you are using the paper shapes, just note that any time the directions say “pasta” it means paper)

1. Label the muffin cups and arrange them as shown:



2. Place eight pieces of pasta, two of each shape, into each cup, using the following color code:

Grandfather 1: red	Grandfather 2: yellow
Grandmother 1: green	Grandmother 2: blue

Using this code, color the pasta for each grandparent on your diagram.

3. The pasta pieces stand for genes, and each pasta shape is a different gene. There are two of each pasta shape because we have two copies of each of our genes. In this example, Grandfather 1 has four pairs of genes, all colored red, and Grandmother 1 has four pairs of genes colored green.

Now you are going to choose the genes for the daughter of Grandfather 1 and Grandmother 1. To do this, select four genes from the Grandfather 1 cup, making sure that you take one of each shape, and take four genes from the Grandmother 1 cup, one of each shape. Close your eyes as you select the genes. Place these pasta pieces in the cup labeled “Mother.” The eight pasta pieces in the “Mother” cup are Mother’s genes, half from her father and half from her mother. Color your diagram.

4. Without looking, take four different genes from Grandfather 2 and four different genes from Grandmother 2 and place in the cup called “Father.” Color the diagram.

5. Mother and Father are going to have four children. Each child gets half of his or her genes from Mother and half from Father. For the first child, select four genes, one of each shape, from Mother's cup and four genes, one of each shape, from Father's cup, and place in the cup labeled "Child." Be sure to close your eyes when you select the genes! Color the diagram to show which genes Child 1 has. What is your child's name?

6. Return the child's genes to the Mother and Father cups. (Mother's genes are red and green, and Father's genes are yellow and blue.) Select genes for Child 2 as you did for the first child, and record your results on the diagram. Repeat this step for Child 3 and Child 4. Remember to color the diagram after each child and return all of Mother's and Father's genes to the correct cups before choosing genes for the next child. Don't forget to name your children!

7. Fill in the data table and answer the questions following the exploration.

Data Table: Pasta Genes

Number of genes from:	**Child 1** _____	**Child 2** _____	**Child 3** _____	**Child 4** _____
Grandfather 1 (red)				
Grandmother 1 (green)				
Grandfather 2 (yellow)				
Grandmother 2 (blue)				
Total # of genes	8			
Total # of gene pairs	4			

Reflect and Explain

1. How many genes did each child inherit from Mother? From Father?

2. How many of each gene (pasta type) does each child receive?

3. Did any of the four children have exactly the same combination of genes?

4. Did every child get at least one of his/her genes from each grandparent?

5. Would it be possible for a child in this activity to have the following combinations of genes:

• eight yellow genes?

• four yellow genes and four red genes?

• three blue genes, two green genes, and three red genes?

WEDNESDAY- Explain

Draw a model to explain what you know about how traits are passed from parents to offspring.

Write an explanation that supports your model.

_____

_____

_____

_____

_____

_____

_____

THURSDAY- Elaborate

Read the attached article, answer the quiz questions and answer the questions below:

1. Where did the four grandparents get their genes?

2. Scientists estimate that we each have about 80,000 genes (40,000 gene pairs). How many genes did you get from your mother? From your father?

3. Do you think it would be possible for a mother and father to have four children with the same combination of genes?

Gregor Mendel discovered laws of genetics: Mendelian inheritance

By Encyclopaedia Britannica, adapted by Newsela staff on 10.16.19
Word Count **371**
Level **1010L**

A color plate from "Breeding and the Mendelian Discovery" by A.D. Darbishire, published in 1912, illustrates the Mendelian inheritance of flower color in the edible pea. To the left is a sample of a pink-flowered race, to the right a sample of a white-flowered race, and in the center a cross between the two. Image by: Oxford Science Archive/Print Collector/Getty Images

Gregor Mendel was an Austrian-born botanist, teacher and monk. He created principles of heredity in 1865. Heredity is how characteristics, or traits, are passed on from parents to future generations.

Mendel studied pea plants, and laid the groundwork for modern genetics. He created a system of particulate inheritance by units, which we know today as genes. Particulate inheritance introduced the idea that offspring inherit individual markers from parents. It's also known as Mendelism. Before Mendel, it was assumed that an offspring's traits were a blend of traits from parents.

Mendel's work was supported by later scientific research and the discovery of chromosomes. Chromosomes are carriers of genetic units made up of DNA. Mendel's work is further explained below, using our understanding of inheritance today.

First Law: Segregation

You inherit half of your genetic information from your mother and half from your father. Mendel's first law is the law of segregation, which states that genes are transferred as separate and distinct units from one generation to the next.

Humans have 46 chromosomes. These chromosomes are sorted into 23 pairs. Each pair includes one chromosome from the mother, and one chromosome from the father. Each chromosome contains one allele, or a different form of a gene. You inherit 23 chromosomes from your mother and 23 from your father.

Second Law: Independent Assortment

The second law is the law of independent assortment, which states that alleles that are passed down aren't related to each other. This means individual alleles can be passed down independently.

The second law means that offspring can have different combinations of traits, which include things such as hair color or eye color. For example, an offspring could have blond hair and blue eyes, or brown hair and brown eyes. Other mixtures of traits are also possible, such as blond hair with brown eyes or brown hair with blue eyes.

Third Law: Dominance

Mendel also developed his third law of dominance, which states that one allele exerts greater influence than the other on the same gene. Mendel developed the concept of dominance from his experiments with pea plants. It was based on the uncertain belief that each plant carried two trait units, one of which dominated the other.

Quiz

1 Which section from the article BEST explains why some alleles have more of an effect on a trait than others?

(A) Introduction [paragraphs 1-3]

(B) "First Law: Segregation"

(C) "Second Law: Independent Assortment"

(D) "Third Law: Dominance"

2 Read the following statement.

Offspring receive genetic information from each of their parents.

Which sentence from the article provides the BEST support for the above statement?

(A) Heredity is how characteristics, or traits, are passed on from parents to future generations.

(B) Before Mendel, it was assumed that an offspring's traits were a blend of traits from parents.

(C) You inherit 23 chromosomes from your mother and 23 from your father.

(D) Mendel developed the concept of dominance from his experiments with pea plants.

3 Why were Mendel's laws of inheritance so groundbreaking?

(A) because he was the first to discover that traits are inherited independently of each other

(B) because he was the first to discover the existence of chromosomes and DNA

(C) because he was the first to discover that an offspring's traits are a blend of its parents' traits

(D) because he was the first to discover that hair and eye color traits are connected

4 How does hair color and eye color affect each other?

(A) They can cause the trait for brown eyes to automatically pair up with the trait for brown hair.

(B) They do not affect each other that much, but they are often on the same allele.

(C) They can cause the trait for blue eyes to automatically pair up with the trait for blond hair.

(D) They do not affect each other because they are separate and distinct alleles.

FRIDAY- Evaluate

Why does sexual reproduction result in offspring with genetic variation?

Write to answer the focus question using Claim, Evidence and Reasoning.

Claim: *(Your answer)*	I think..
Evidence: *(Scientific data)*	My evidence is..
Reasoning: *(Science knowledge that you know that connects your data to your claim)*	My evidence matters because …

Draw a model that supports your answer:

Electromagnetic Forces

Week of: May 11				
Focus Question: How are electricity and magnetism related?				
Monday- Engage	Tuesday- Explore	Wednesday- Explain	Thursday- Elaborate	Friday- Evaluate
On Monday, you are going to... Think about pucks with negative and positive attraction.	On Tuesday, you are going to ... Explore with balloons in your home.	On Wednesday, you are going to ... Draw a model and write an explanation about how static electricity works.	On Thursday, you are going to ... Read about electricity and magnets .	On Friday, you are going to ... Write an explanation of magnets using claim, evidence and reasoning that answers the focus question.

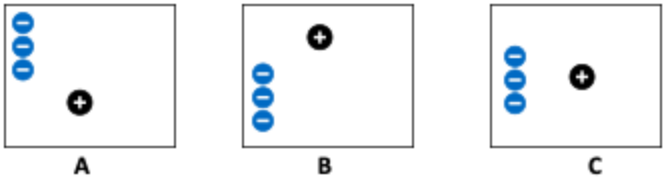
MONDAY- Engage

Answer the questions below:

1. When you pull clothes out of the dryer, sometimes they stick together. What do you think might explain why they stick?

2. What do you think happens in the dryer that makes the clothes stick together?

1. The pictures below show positive and negative circles. The negatives are stuck in place, but the positive is free to move:



a. For each picture above, draw arrows on the positive circle (+) to show which way you think it will move.
b. In which picture below, do you think the positive circle would go the fastest? (Circle your answer)

Why?

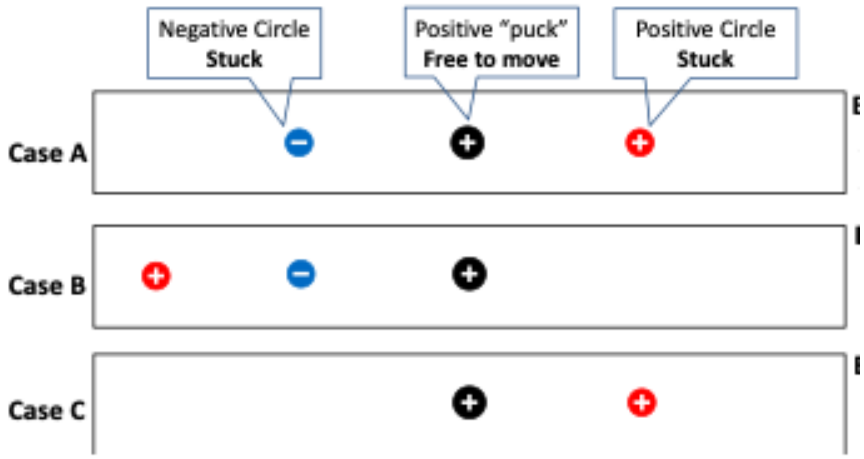
_____

_____

4. In the pictures below, the middle positive “pucks” are free to move, and have some positive and negative circles are stuck down on either side of them.

For each case (A, B, and C), do you think the middle positive “puck” will move or not move?

If the puck will move, draw an arrow on the “puck” to show which way you think it will move. If the puck won’t move, write that down.



Complete the first two boxes in the KWL chart:

What I already **know** about this topic:	What I **want** to know about this topic:	What I have **learned** about this topic:

TUESDAY- Explore

For this activity you will need a few balloons. If you do not have balloons in your house, skip this section and try the virtual activity.

Blow up a few balloons and try rubbing them on different parts of your clothing, your house, other balloons, your hair, etc. and write down your observations in the box below.

Balloon observations:

You just made some observations with balloons – sticking and repelling.

Write down your ideas about why the balloons would stick to things (like hair) after rubbing on your head? And repel from each other?

Use words and pictures to describe your ideas about what might be going on.

PLay around with the PHeT Simulation on charges and fields:
https://phet.colorado.edu/sims/html/charges-and-fields/latest/charges-and-fields_en.html

Write down your observations about what happens when you add positive and negative charges. Create at least three different set-ups and draw them in the boxes below:

WEDNESDAY- Explain

Draw a model to explain what you know about electricity and attraction.

Write an explanation that supports your model.

_____

_____

_____

_____

_____

_____

_____

THURSDAY- Elaborate

Read both the attached articles and answer the questions.

"Flying" trains (1998)

By Cricket Media, adapted by Newsela staff on 12.18.19
Word Count **592**
Level **950L**

Image 1. A maglev train brings passengers out of the Pudong International Airport in Shanghai, China. Maglev trains are powered by electromagnets. Photo by: Alex Needham via Wikimedia Commons

Editor's Note: This story was originally published May 1, 1998, in Odyssey Magazine.

The maglev train is the world's fastest train -- yet it doesn't even have an engine. Instead, it operates using powerful electromagnets. An electromagnet is a magnet with an electrical current running through it.

Known as magnetic levitation, this feat of physics allows these trains to be lifted off their tracks and propelled forward at speeds up to 600 kilometers per hour (around 370 miles per hour).

Trains that use magnetic levitation are known as maglev trains. They have been built and are in operation in Japan, China and South Korea. In the United States, cities like Baltimore, Maryland, and Washington, D.C., are looking into having maglev trains too.

Electricity Propels Electromagnets

To understand how maglev trains work, it helps to review magnetic forces. Every magnet has a north pole and a south pole. Opposite poles of two magnets attract each other; like poles repel, or

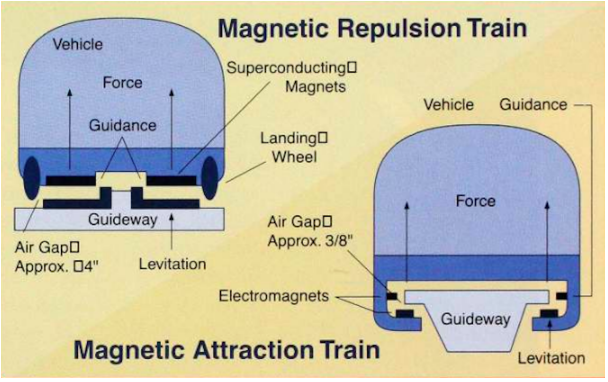
push each other away. This action of pushing away is also called repulsion.

Permanent magnets, like iron, are always magnetic. Electromagnets are magnetic only when an electric current flows through them. When some thing has an electrical current, it means that there is a flow of tiny particles called electrons. The north and south poles of an electromagnet are related to the direction of the current. If the direction of the current is reversed, the poles are reversed too.

A Track With Electric Motors

To picture how a maglev train moves, think of three bar magnets lined up on the floor. The magnet in front pulls with an opposite magnetic pole. The magnet in back pushes with the same magnetic pole. The magnet in the middle moves forward.

Maglev trains are moved by electric motors located in the guideway. The guideway is the single track that the train sits on. The motors are long machines that contain a series of electromagnets. These pull the train in front and push it from behind. The electromagnets can quickly change their poles, which moves the train forward.



How Trains Levitate

Some maglev trains levitate, or float, by the repulsion.
Like poles repel and push the train upward. This system was designed for maglev trains that contain groups of extremely powerful superconducting electromagnets. Superconducting is a state in which electricity moves freely through a metal without anything stopping it. These magnets use less electricity than conventional electromagnets, but they must be cooled to temperatures as low as minus 267 degrees Celsius (minus 450 degrees Fahrenheit).

Other maglev trains levitate by magnetic attraction. In this method, like poles repel and push the train forward. Opposite poles attract and pull the car forward. Imagine a C-shaped bracelet floating around your wrist without touching it. Magnets on the underside of the guideway are positioned to attract the opposite poles of magnets in the wraparound section of the track. This raises the train off the track a few centimeters into a "floating" position. The wraparound section does not touch the guideway.

Developers say that since the train doesn't touch the tracks, maglevs have higher directional speed, lower energy use, less wear, and quieter operation than regular trains.

Quiz

1 Read the section "How Train Levitates."

Select the detail from the article that suggests maglev trains are better than regular trains.

(A) This system was designed for maglev trains that contain groups of extremely powerful superconducting electromagnets.

(B) Other maglev trains levitate by magnetic attraction. In this method, like poles repel and push the train forward.

(C) This raises the train off the track a few centimeters into a "floating" position. The wraparound section does not touch the guideway.

(D) Developers say that since the train doesn't touch the tracks, maglevs have higher directional speed, lower energy use, less wear, and quieter operation than regular trains.

2 Read the conclusion below.

Although maglev trains have benefits, they also create difficult problems to solve.

Which sentence from the article provides the BEST support to the statement above?

(A) Known as magnetic levitation, this feat of physics allows these trains to be lifted off their tracks and propelled forward at speeds up to 600 kilometers per hour (around 370 miles per hour).

(B) The electromagnets can quickly change their poles, which moves the train forward.

(C) These magnets use less electricity than conventional electromagnets, but they must be cooled to temperatures as low as minus 267 degrees Celsius (minus 450 degrees Fahrenheit).

(D) Magnets on the underside of the guideway are positioned to attract the opposite poles of magnets in the wraparound section of the track.

3 Read the section "Electricity Propels Electromagnets."

What does this section explain that other sections DO NOT?

(A) how maglev trains are different from regular trains

(B) how electromagnets are different from other magnets

(C) how maglev trains use magnets to operate

(D) how superconducting electromagnets work

4 Read the section "How Train Levitates."

How does this section contribute to the article's MAIN idea?

(A) It illustrates different methods that are used to operate maglev trains.

(B) It emphasizes how much faster maglev trains are than other trains.

(C) It introduces the role that magnets play in maglev train operation.

(D) It addresses varioius complaints people have about maglev trains.

How electricity and magnetism are connected

By ThoughtCo.com, adapted by Newsela staff on 10.31.19
Word Count **577**
Level **930L**

Image 1. A simple electromagnet shows how electricity and magnetism are connected. An electromagnet is a type of magnet in which the magnetic field is generated by an electric current. Photo by: Jasmin Awad, EyeEm/Getty Images

Electricity and magnetism are separate yet interconnected phenomena. Together they form the basis for electromagnetism. This is the study of charge and the forces associated with charge.

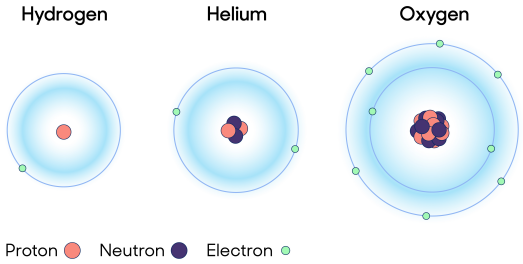
Aside from the force of gravity, almost everything stems from electromagnetism. These forces are responsible for the interactions between atoms and the flow of energy, as well as responsible for nuclear force. This controls the formation of an atom's nucleus and its breakdown, or decay.

Yet how do we define electricity and magnetism, and how do they work? Read on to find out.

The Atom Defined

Atoms are basic units of matter. They are defined by their chemical elements in the periodic table. An atom contains protons, neutrons and electrons. Protons and neutrons exist within the nucleus of an atom. Electrons move around an atom. In a neutral state, an atom or molecule has the same number of protons and electrons.

Electricity is the phenomenon of electric charges. This includes whether they are stopped or moving. Electric charge comes from protons and electrons. Protons have a positive charge and electrons have a negative charge.



An electric charge can also come from an ion. An ion is an atom or molecule that has an uneven number of protons and electrons. This results in the ion or molecule having a positive or negative charge.

Positive and negative charges attract each other. This means that protons are attracted to electrons. On the other hand, like charges repel each other, which means that protons repel other protons and electrons repel other electrons.

Electricity And The Force Of Magnetism

One example of electricity includes lightning, which occurs naturally. Another example is the flow of electricity that comes from an outlet or battery. Some common units of measuring electricity include the ampere (A) or amp, voltage (V) and watt (W). These units, along with others, describe the flow of electricity, also known as electrical current.

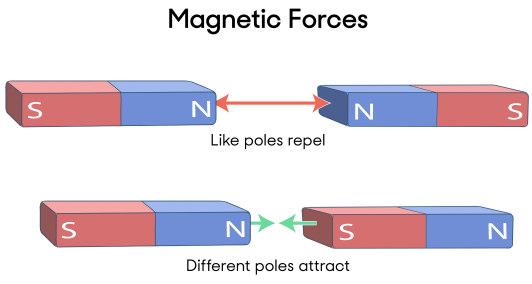
When a particle is stationary, or stopped, it has an electric field.

Magnetism is the phenomenon of moving electric charge. This motion creates a magnetic force that influences the particles around it. The force, described as a magnetic field, can also trigger charged particles to move, producing an electric current.

In magnetism, like electricity, particles with opposite charges are attracted to each other. Particles with similar charges are repelled from each other. Any magnetic particle or object has a "north" and "south" pole with the directions are based on the orientation of the Earth's magnetic field. Earth's magnetic field is created from moving iron in the Earth's core.

Earth's Magnetic Field

One example of magnetism is a compass needle's reaction to Earth's magnetic field. Another example is bar magnets attracting and repelling each other, or electrons moving around atoms to produce a magnetic field. Power lines, hard discs and speakers rely on magnetic fields to function. Magnetism, like electricity, also has associated units of measurement, such as the tesla (T).



Special waves such as light have both electric and magnetic characteristics. The two features of the wave travel in the same direction but oriented at a right angle (90 degrees) to one another.

Quiz

1 Read the section "The Atom Defined."

Select the sentence from the article that suggests that molecules can exist without a charge.

(A) In a neutral state, an atom or molecule has the same number of protons and electrons.

(B) Protons have a positive charge and electrons have a negative charge.

(C) An ion is an atom or molecule that has an uneven number of protons and electrons.

(D) This results in the ion or molecule having a positive or negative charge.

2 Why does Earth have a magnetic field? How do you know?

(A) because the Earth has an electric current; "The force, described as a magnetic field, can also trigger charged particles to move, producing an electric current."

(B) because objects on Earth have a "north" and "south" pole; "Any magnetic particle or object has a "north" and "south" pole with the directions are based on the orientation of the Earth's magnetic field."

(C) because iron is moving in the Earth's core; "Earth's magnetic field is created from moving iron in the Earth's core."

(D) because power lines, hard discs and speakers create it; "Power lines, hard discs and speakers rely on magnetic fields to function."

3 Which sentence from the introduction [paragraphs 1-3] BEST introduces electromagnetism to the reader?

(A) Together they form the basis for electromagnetism.

(B) This is the study of charge and the forces associated with charge.

(C) Aside from the force of gravity, almost everything stems from electromagnetism.

(D) Yet how do we define electricity and magnetism, and how do they work?

4 What is MOST likely the reason the author included the information about the ampere, voltage and watt?

(A) to show units that can measure nuclear formation and decay

(B) to show units that can measure how compasses move

(C) to highlight different units that measure how hot lightning is

(D) to highlight different units that measure electrical currents

FRIDAY- Evaluate

How are electricity and magnetism related?

Write to answer the focus question using Claim, Evidence and Reasoning.

Claim: *(Your answer)*	I think..
Evidence: *(Scientific data)*	My evidence is..
Reasoning: *(Science knowledge that you know that connects your data to your claim)*	My evidence matters because …

Draw a model that supports your answer:

Gravity and Kinetic Energy

Week of: May 18th- May 22nd, 2020				
Focus Question: How does the Law of Inertia apply to the real world?				
Monday (5/18)- Engage	**Tuesday (5/19)-** Explore	**Wednesday (5/20)-** Explain	**Thursday (5/21)-** Elaborate	**Friday (5/22)-** Evaluate
On Monday, you are going to view a video on Science of NFL football. This video will illustrate Newton's first law of motion. You will also view a picture that will explain Newton's first law of motion.	On Tuesday, you are going to complete an experiment that will give you a deeper understanding of how Newton's first law of motion work. You should record your observations on your Newton's Laws data sheet.	On Wednesday, you are going to draw a model to explain what you know about Newton's first law of motion and draw an explanation to support your model.	On Thursday, you are going to read a passage about Isaac Newton's first law of motion. After reading you will answer comprehension questions and activities.	On Friday, you are going to complete your exit ticket.

MONDAY- Engage

Watch this video: https://www.youtube.com/watch?v=08BFCZJDn9w

Complete the first two boxes in the KWL chart:

What I already **know** about this topic:	What I **want** to know about this topic:	What I have **learned** about this topic:

TUESDAY- Explore

Here are the instructions for the lab/at home activity:

1) Newton's First Law (Law of Inertia): An object at rest stays at rest and an object in motion stays in motion unless acted upon by an outside force."

Materials for the Ball Bounce Experiment:

- A basketball or soccer ball, or similar bouncy ball
- a smaller bouncy ball (like a tennis ball or a racquet ball).
- Have an assortment of other balls handy for further experimenting.

Procedure:

- Do this experiment outside if possible
- First bounce the basketball and tennis ball side by side to compare their bounces. Start them off around chest height
- Make a hypothesis (a guess) about what will happen when you stack the small ball on top of the bigger one and then drop it
- It may take a couple tries to line them up just right but the results are pretty awesome.

Explanation:

- The energy of motion from the bigger ball is transferred into the smaller one. Most of your attention is on the sky-rocketing smaller ball, but if you look at the basketball, it doesn't have much bounce at all!

Experiment further:

- Hopefully this will make you think of other things. Like what if you switched the two balls and dropped the smaller one on the bottom? What if you used two of the same sized ball? A golf ball on top? Think of other things!

Record your observations and draw a picture of what happened in your science notebook.

*RECORD YOUR OBSERVATIONS ON YOUR NEWTON'S LAW DATA SHEET BELOW.

Name:_____

Newton's Law of Motion Data Sheet:

Experiment:	Observations (Draw a sketch or diagram of the experiment) and make any notes	Explanation (How does this experiment demonstrate Newton's First Law of Motion?)
1 **Ball Bounce**		

WEDNESDAY- Explain

Draw a model to explain what you know about Newton's first law of motion.

Write an explanation that supports your model.

THURSDAY- Elaborate

Read the article below and answer the questions that follow.

Underline or highlight the parts of the passage below that answer the following questions:

1. What is inertia?
2. How does inertia affect motion?
3. What is the relationship between mass and inertia?

Inertia is the tendency of an object to resist a change in its motion. If an object is already at rest, inertia will keep it at rest. If the object is already moving, inertia will keep it moving. This tendency was first described by Isaac Newton and is known as Newton's First Law of Motion or the Law of Inertia. Think about what happens when you are riding in a car that stops suddenly. Your body moves forward on the seat. Why? The brakes stop the car but not your body, so your body keeps moving forward because of inertia. That's why it's important to always wear a seat belt.

The inertia of an object depends on its mass. Objects with greater mass also have greater inertia. Think how hard it would be to push a big cardboard box full of books. Then think how easy it would be to push the box if it was empty. The full box is harder to move because it has greater mass and therefore greater inertia. An object's motion changes (or accelerates) when it is acted on by an unbalanced force. A force is unbalanced if the net (total) forces acting on object is not zero. Acceleration depends on the size of the force and the mass of the object.

Determine if the following statements are true or false.

_____ 4. Inertia is the tendency of an object to resist motion.
_____ 5. Newton's first law of motion is also called the law of acceleration.
_____ 6. If an object is at rest, inertia will keep it at rest.
_____ 7. The inertia of an object is determined by its speed.
_____ 8. The speed of an object changes only when it is acted on by an unbalanced force.
_____ 9. A stationary object resists movement only because of gravity.
_____ 10. The tendency of an object to resist a change in motion depends on its mass.

_____ 11. Newton's first law of motion applies only to objects that are already moving.

Match each definition with the correct term.

Definitions:	**Terms:**
_____ 12. combination of all the forces acting on an object _____ 13. an object's motion will not change unless an unbalanced force acts on it _____ 14. factor that determines the inertia of an object _____ 15. type of force needed to overcome inertia of an object _____ 16. tendency of an object to resist a change in motion	a. inertia b. unbalanced force c. law of inertia d. mass e. net force

FRIDAY- Evaluate

Write to answer the focus question using Claim, Evidence and Reasoning.

Draw a model that supports your answer:

Week 4: (May 25th - May 29th)
Waves

Focus Question: **What are the basic parts and characteristics of a wave?**

Directions: Throughout this week you will be working to answer this focus question: *What are the basic parts and characteristics of a wave?* At the end of the week, you will need to answer the question in detail and create a model. The activities Monday - Thursday will help you answer the focus question and give you the science vocabulary you will need to successfully answer it.

Week 4 Activity 1a. Image: *Observations* and *Inferences* about Waves (Engage) Monday, 5/25/20

Directions: Look at the image on the right. Why does the area behind the plane look like that ? Make three observations and three inferences about it. **Make sure to respond in complete sentences.**

Observations	Inferences

Week 4 Activity 1b. KWL Chart (Engage) Monday, 5/25/20

Directions: First, write down What You Know about the term *wave* in regards to water, light, heat, etc. Next, write down What You Wonder about waves Finally, once you complete this week's assignments, complete the What I Learned portion of this table on Friday. Make sure you respond in complete sentences. ***You should have at least 2 things in each column.***

What I **K**now about waves	What I **W**onder about waves	What I **L**earned about waves (complete on Friday)

Optional Video - If you have access to the internet, click the link to watch the video below and answer the following questions. Waves

1. Why didn't the ball move with the waves in the container?

2. What is wavelength?

3. How is wavelength related to wave energy?

4. What is amplitude?

Week 4 Activity 2. Waves Lab (Explore) Tuesday, 5/26/20

Directions: *The following activity is optional. It should only be completed if you have the supplies at home and are able to use them. Ask your family for permission before completing the activity!*

Overview

In this investigation, you will be exploring the bending of light rays, or **refraction**. You will examine what happens to light rays as they pass from the air, into oil, and then water. You will place a pencil in a cup that contains a layer of oil and water. You will then observe what happens to the image of the pencil.

Question: What happens to light rays as they pass through different objects?

Hypothesis: What do you think is going to happen?_____

Vocabulary: Refraction: Refraction occurs when a light ray gets bent while travelling from one substance to another substance due to change in the speed of light or change in the direction.

Magic Breaking Pencil: Light Refraction Mini Lab

Materials

- Pencil
- Vegetable oil
- Glass
- Water

Procedure

1. Fill a glass half with water and half with oil.

2. Lower the pencil in the water, then slowly rotate it until it looks broken from the side.

3. Observe what happens as to the pencil images as it passes through the layer of oil and water
    a. Look at the glass from above. How does the pencil appear?
    b. Look at the glass from below. How does the pencil appear?
    c. Look at the glass from the front. How does the pencil appear?
    d. Look at the glass from the back. How does the pencil appear?
4. Record your observations and sketches in the chart below.

View	Observations	Sketch
Top		
Below		
Front		
Back		

Part 2: *Analysis*

1. How did the image of the pencil change as you looked at it through the different layers of oil and water?

2. What happened to the view of the pencil as you looked at it from different angles? Why?

3. This activity demonstrates refraction. How?

Optional Video - If you have access to the internet, click the link to watch the video below and answer the following questions.Refraction of Light

1. What is refraction of light?

2. What are the media the light has to pass through?

3. Why did the wand appear to be bent?

Week 3 Activity 3. Creating Models (Explain) Wednesday, 5/27/20

Use the space below to create a model of refraction using a pencil in a cup of water. Make sure to label the following: cup, water, light rays, pencil

Why is this a model of refraction?

Use the space below to create a model of a wave with a short wavelength. Make sure to label the following: crest, trough, wavelength, amplitude

How would you describe the frequency of this wave? Why?

Use the space below to create a model of a wave with a long wavelength. Make sure to label the following: crest, trough, wavelength, amplitude

How would you describe the frequency of this wave? Why?

Week 4: Activity 4: (Elaborate) Thursday, 5/28/20

Directions: Read and annotate the passage below. Once you have finished, answer the questions at the end.

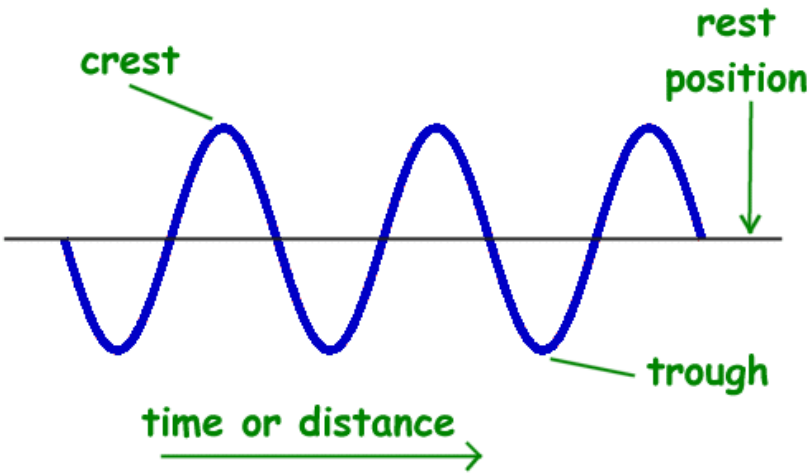
Physics for Kids

Properties of Waves

There are many properties that scientists use to describe waves. They include amplitude, frequency, period, wavelength, speed, and phase. Each of these properties is described in more detail below.

Graphing a Wave

When drawing a wave or looking at a wave on a graph, we draw the wave as a snapshot in time. The vertical axis is the amplitude of the wave while the horizontal axis can be either distance or time.

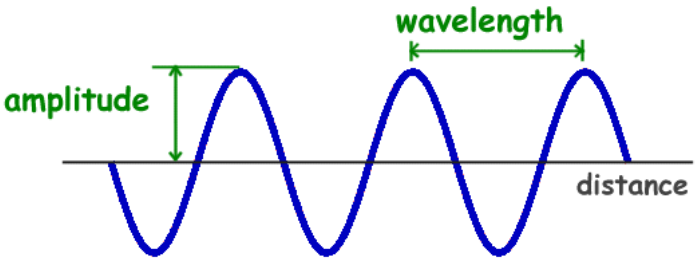


In this picture you can see that the highest point on the graph of the wave is called the crest and the lowest point is called the trough. The line through the center of the wave is the resting position of the medium if there was no wave passing through.

We can determine a number of wave properties from the graph.

Amplitude

The amplitude of a wave is a measure of the displacement of the wave from its rest position. The amplitude is shown on the graph below.



Amplitude is generally calculated by looking on a graph of a wave and

measuring the height of the wave from the resting position.

The amplitude is a measure of the strength or intensity of the wave. For example, when looking at a sound wave, the amplitude will measure the loudness of the sound. The energy of the wave also varies in direct proportion to the amplitude of the wave.

Wavelength

The wavelength of a wave is the distance between two corresponding points on back-to-back cycles of a wave. This can be measured between two crests of a wave or two troughs of a wave. The wavelength is usually represented in physics by the Greek letter lambda (λ).

Frequency and Period

The frequency of a wave is the number of times per second that the wave cycles. Frequency is measured in Hertz or cycles per second. The frequency is often represented by the lower case "f."

The period of the wave is the time between wave crests. The period is measured in time units such as seconds. The period is usually represented by the upper case "T."

The period and frequency are closely related to each other. The period equals 1 over the frequency and the frequency is equal to one over the period. They are reciprocals of each other as shown in the following formulas.

$$\text{period} = 1/\text{frequency}$$
$$\text{or}$$
$$T = 1/f$$

$$\text{frequency} = 1/\text{period}$$
$$\text{or}$$
$$f = 1/T$$

Speed or Velocity of a Wave

Another important property of a wave is the speed of propagation. This is how fast the disturbance of the wave is moving. The speed of mechanical waves depends on the medium that the wave is traveling through. For example, sound will travel at a different speed in water than in air.

The velocity of a wave is usually represented by the letter "v." The velocity can be calculated by multiplying the frequency by the wavelength.

$$\text{velocity} = \text{frequency} * \text{wavelength}$$

or

$v = f * \lambda$

Analysis Questions

Circle the correct answer.

1) When graphing a wave, what does the horizontal axis usually represent?

a. Amplitude
b. Trough
c. Time or distance
d. Crest
e. Rest position

2) What does the horizontal line through the center of the wave on a graph represent?

a. Amplitude
b. Trough
c. Time or distance
d. Crest
e. Rest position

3) When graphing a wave, what does the vertical axis usually represent?

a. Amplitude
b. Trough
c. Time or distance
d. Crest
e. Rest position

4) What do we call the highest point of the wave on a graph?

a. Amplitude
b. Trough
c. Time or distance
d. Crest
e. Rest position

5) What do we call the lowest point of the wave on a graph?

a. Amplitude
b. Trough
c. Time or distance
d. Crest

e. Rest position

6) What wave measurement represents the number of times per second that the wave cycles?

a. Wavelength
b. Period
c. Amplitude
d. Frequency
e. Velocity

7) What wave measurement would you find by measuring the distance between the crests of back-to-back wave cycles?

a. Wavelength
b. Period
c. Amplitude
d. Frequency
e. Velocity

8) What wave measurement would you find by measuring the time between the crests of back-to-back wave cycles?

a. Wavelength
b. Period
c. Amplitude
d. Frequency
e. Velocity

9) What wave measurement represents the strength or intensity of the wave?

a. Wavelength
b. Period
c. Amplitude
d. Frequency
e. Velocity

10. In the space below, draw and label the parts of a basic wave. Be sure to include the following: amplitude, wavelength, crest, trough.

Week 4: Activity 5: Claim, Evidence, Reasoning (Evaluate) Friday, 5/29/20

Directions: Read the scenarios below. Answer them using the claim, evidence, reasoning format.

1. Marcus was talking to Andrew about waves. He told Andrew that the greater the wavelength, the less the frequency and energy wave will have. Andrew disagreed. He said that the greater the wavelength, the greater the frequency and energy a wave will have. Who was correct? What is your evidence? How does this evidence prove your claim? Fill in the boxes below.

Claim	Evidence	Reasoning

2. Draw a model below showing the example of a wave that proves backs up the evidence of your claim above. Make sure to label the following: crest, trough, wavelength, amplitude