Lesson #1

Day 1
8th

Kinetic Energy, Part I

Energy is the ability to cause change. We observe energy when we see light or motion, when we feel heat or vibrations, and when we hear sounds. These are just a few examples. Energy is all around us, and it is in everything.

Although we observe energy in a variety of phenomena, it is all the same energy. It just presents itself in different ways. Some energy is in motion, and some is stored in fields.

Energy of motion is called **kinetic energy**. Motion is movement—a robot marching, a bird flying, or the wind blowing. Energy is related to mass, the amount of matter of an object. It is also related to velocity, how fast or how slow the object is moving.

The greater an object's velocity, the more kinetic energy it has. For example, a car speeding along the highway has more kinetic energy than the same car traveling slowly through a school zone. A baseball hurled by a major league pitcher has more kinetic energy than the same baseball tossed by a Little League pitcher.

Study the table. The mass of each car is the same, but each car has a different velocity. As the velocity increases, note how the kinetic energy increases.

Object	Mass (kg)	Velocity (km/hr)	Kinetic Energy (J)
Car A	700	100	270,000
Car B	700	120	390,000
Car C	700	140	530,000

As velocity increases, kinetic energy increases (when the mass is the same).

The greater an object's mass, the more kinetic energy it has. For example, when a motorcycle and a school bus move at the same speed, the bus has greater kinetic energy. When moving at the same speed, a heavy bowling ball has more kinetic energy than a playground ball filled with air.

Study the table. The velocity of each horse is the same, but the mass of each horse is different. The heavier the horse, the greater the kinetic energy.

Object	Mass (kg)	Velocity (km/hr)	Kinetic Energy (J)
Horse A	450	48	40,000
Horse B	550	48	49,000
Horse C	650	48	57,000

As mass increases, kinetic energy increases (when velocity is the same).

1. _____ is the energy of motion.

   Potential energy Kinetic energy Solar energy

2. True or False? If a statement is false, explain why on the line below.

   _____ Energy is found in motion, and it is stored in fields.

   _____ Energy is the ability to cause change.

   _____ As velocity increases, kinetic energy decreases.

   _____ Energy can be observed as heat, sound, or vibrations.

   _____

3. Alex has a mass of 90 kg. His daughter's mass is 45 kg. They are jogging together at 8 km/hr. Who has more kinetic energy?

   Alex his daughter neither

4. Tommy and Anita are racing their remote-controlled cars. Both cars have the same mass. Tommy's car is travelling at 2 km/hr. Anita's car moves at 2.5 km/hr. Which car has more kinetic energy?

   Tommy's car Anita's car neither

5. Mimi and her twin sister, DeDe, have the same mass. They are riding together in the back seat of their aunt's car. Mimi's kinetic energy is (more / less / equal to) DeDe's kinetic energy.

6. True or False?

   _____ The particles that make up matter are constantly moving. They have kinetic energy.

7. Metric units of measurements include _____. Choose all that apply.

grams	Fahrenheit	meters
pounds	second	inches

8. Scientists and engineers ask questions and conduct investigations to find answers that are based on (fact / opinion).

9. Is the following sentence a scientific question?

   Is it easier to wear your school backpack or to pull it on wheels?

   yes no

Day 2
8th

Lesson #2

Kinetic Energy, Part II

Remember, kinetic energy is related to mass and velocity. We can use tables to show these relationships. Use table 1 and table 2 to complete the items below.

Table 1		
Mass (kg)	Velocity m/s	Kinetic Energy (J)
10	10	500
20	10	1,000
40	10	2,000
80	10	4,000

Table 2		
Mass (kg)	Velocity m/s	Kinetic Energy (J)
10	10	500
10	20	2,000
10	40	8,000
10	80	32,000

1. The kinetic energy of an object is related to its _____ and _____.

2. Study table 1, and complete these statements.

   Mass (doubles / quadruples / stays the same) from one row to the next.

   Velocity (doubles / quadruples / stays the same) from one row to the next.

   Kinetic energy (doubles / quadruples / stays the same) from one row to the next.

3. Based on table 1, what is the relationship between <u>mass</u> and kinetic energy?

   A) When mass changes, kinetic energy changes by the same factor.
   B) When mass changes, there is no change in kinetic energy.
   C) When mass increases, kinetic energy decreases.
   D) There is no relationship between mass and kinetic energy.

4. Study table 2, and complete these statements.

   Mass (doubles / quadruples / stays the same) from one row to the next.

   Velocity (doubles / quadruples / stays the same) from one row to the next.

   Kinetic energy (doubles / quadruples / stays the same) from one row to the next.

5. Based on table 2, what is the relationship between <u>velocity</u> and kinetic energy?

   A) When velocity changes, kinetic energy changes by the same factor.
   B) When velocity changes, there is no change in kinetic energy.
   C) When velocity increases by a factor x, kinetic energy changes by x^2.
   D) There is no relationship between velocity and kinetic energy.

Use the relationships you learned from the previous page to answer the following questions.

6. Two birds are flying at the same speed. The hawk has a mass of 2 kg. The bald eagle has a mass of 6 kg.

   The masses differ by a factor of _____.

   So the kinetic energy of the birds will differ by a factor of _____.

   If the kinetic energy of the hawk is 150 J, then the kinetic energy of the bald eagle is _____ J.

7. An object is moving at a velocity of 5 m/s. The object's velocity increases to 15 m/s.

   The object's velocity has changed by a factor of _____.

   So the kinetic energy of the object will change by a factor of _____.

   The object originally had 50 J of kinetic energy. What is its kinetic energy now?

   200 J 250 J 300 J 450 J

8. If a 10 kg object has a kinetic energy of 500 J, how much kinetic energy does a 40 kg object moving at the same speed have?

   500 J 1,000 J 2,000 J 4,000 J

9. Kinetic energy is measured in which unit of measurement?

   newtons Celsius joules kilowatts

10. During an experiment, a scientist manipulates the (independent / dependent) variable to observe how the (independent / dependent) variable may change.

11. Scientists use a variety of tools to make observations and take measurements. Match each instrument with its clue.

_____	thermometer	A) mass
_____	triple beam balance	B) temperature
_____	meter stick	C) length or distance
_____	graduated cylinder	D) volume of a liquid

12. A basketball and a tennis ball are moving at the same rate. Circle the ball that has more kinetic energy.

624 grams

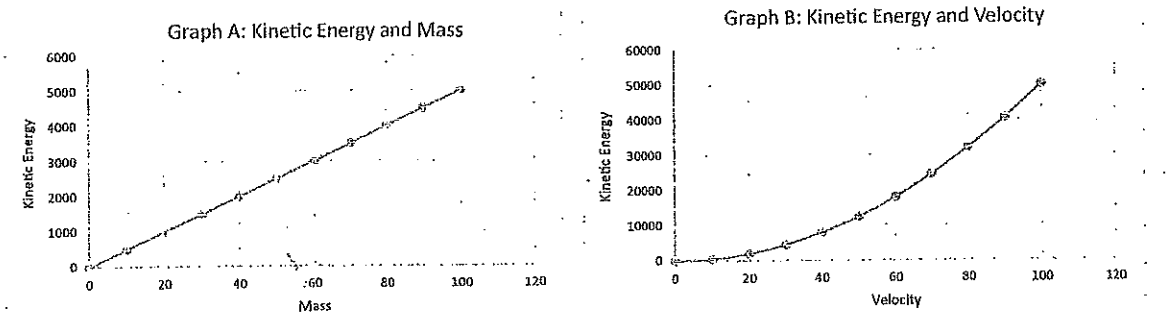
57 grams

Day 3
8th

Lesson #3

Kinetic Energy, Part III

Study the graphs below. Graph A shows the relationship between kinetic energy and mass when velocity remains constant. Graph B shows the relationship between kinetic energy and velocity when mass is held constant.



1. A graph of mass and kinetic energy forms a straight line starting at the origin. What does this graph tell us?

   A) Mass and kinetic energy are proportional.
   B) As mass increases, kinetic energy increases.
   C) The two variables are increasing by the same factor.
   D) all of these

2. In graph B, mass remains constant while velocity changes. Why does a graph of velocity and kinetic energy form a curved line?

   A) As velocity increases, kinetic energy increases.
   B) Kinetic energy and velocity are not proportional.
   C) Velocity and kinetic energy change by different factors.
   D) all of these

3. Compare the two graphs again. Which variable has a greater effect on kinetic energy?

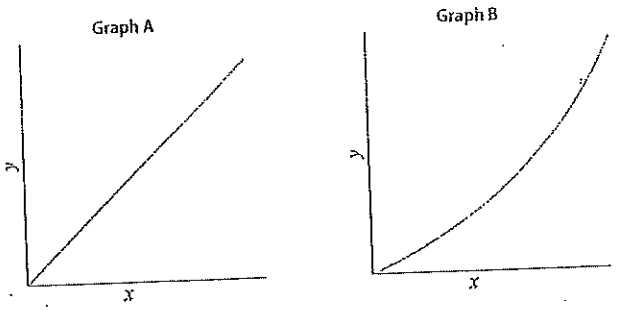
   mass velocity both mass and velocity have the same effect

4. According to graph B, when the velocity of an object is zero, the kinetic energy of the object will be _____.

5. As the velocity of an object decreases, the object has (more / less) kinetic energy.

6. If two objects have the same velocity, the object with more mass will have (more / less) kinetic energy.

Study the graphs.



7. Write the letter of each graph next to the term that describes it.

_____ proportional

_____ not proportional

8. When two variables are proportional, they change by the same factor. Which graph would represent variables that are proportional?

graph A graph B

This graph would represent the relationship between kinetic energy and (mass / velocity).

9. Sometimes, two variables do not change at a constant rate. Which graph would represent these variables?

graph A graph B

This graph would represent the relationship between kinetic energy and (mass / velocity).

10. On graphs, the variable plotted on the x-axis is the (independent / dependent) variable, and the (independent / dependent) variable is plotted along the y-axis

11. A car increases its velocity from 30 km/hr to 60 km/hr. The velocity has changed by a factor of 2. By what factor has the car's kinetic energy changed?

2 4 30 60

If the kinetic energy of the car was originally 7,000 J, what is the car's kinetic energy after it speeds up?

7,000 J 14,000 J 28,000 J 49,000 J

12. A(n) _____ is a possible explanation for something that a scientist has observed.

variable fact hypothesis inquiry

Day 4
8th

Lesson #4

Kinetic Energy, Part IV

As the previous lessons showed, kinetic energy is proportional to the mass of the moving object. Kinetic energy increases with the square of the object's velocity. These relationships can be expressed using the following equation:

$$\text{Kinetic Energy} = \tfrac{1}{2} \times \text{mass} \times \text{velocity}^2 = \tfrac{1}{2}mv^2$$

The equation shows that kinetic energy is related to mass and velocity. If we know an object's mass in kilograms (kg) and its velocity in meters per second (m/s), we can calculate the object's kinetic energy in joules (J).

For example, a six-kilogram bowling ball rolls down the alley at eight meters per second.

$$\text{Kinetic Energy} = \tfrac{1}{2} \times 6\ \text{kg} \times (8\ \text{m/s})^2 = ?$$
$$\tfrac{1}{2} \times 6\ \text{kg} \times (8 \times 8) = ?$$
$$\tfrac{1}{2}(6 \times 64) = ?$$
$$\tfrac{1}{2}(384) = 192\ \text{J}$$

The kinetic energy of the bowling ball is 192 joules.

1. Mathematical formulas are models used by scientists and engineers to represent relationships among variables. Complete the formula for calculating kinetic energy. KE = ½ x _____ x _____^{2}

2. Use the formula to calculate the kinetic energy of a 50 kg bicycle that is moving at 4 m/s.

   _____

3. How much kinetic energy will the 50 kg bicycle have if it speeds up from 4 km/hr to 8 km/hr?

   _____

4. (Mass / Velocity) has an exponential effect on kinetic energy.

5. The kinetic energy of an object is proportional to the object's mass. If two objects have the same velocity, the object with twice as much mass will have (twice / four times) as much kinetic energy.

6. Look at the formula for calculating kinetic energy. Which statement is true?

   A) Velocity affects kinetic energy more than mass does.
   B) Velocity affects kinetic energy less than mass does.
   C) Velocity and mass affect kinetic energy equally.
   D) Velocity and mass have no effect on kinetic energy.

7. As velocity increases by x, kinetic energy will increase by a factor of x^2. If the velocity of an object increases by a factor of 4, the kinetic energy increases by a factor of _____.

8. Recall that velocity is the speed of an object moving in a certain direction. Which of the following units do scientists and engineers use to describe speed?

   miles per hour grams per cubic centimeter meters per second

9. Read the hypothesis. Underline the independent variable.

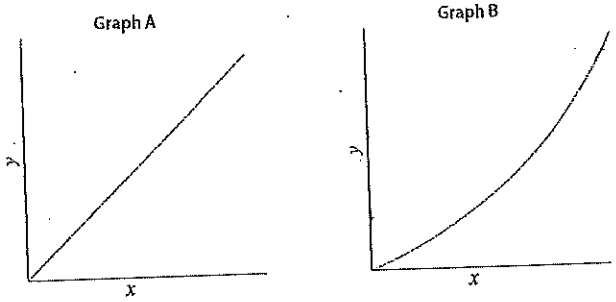
   An object's kinetic energy will increase exponentially if the object's velocity increases.

10. Choose the correct phrase.

    (Quantitative / Qualitative) data is numerical.

    (Quantitative / Qualitative) data describes qualities or characteristics.

11. Which graph shows that y is proportional to x? graph A graph B



12. The table shows the relationship between the miles a car is driven and the amount of gas that is used.

Kilometers Driven	Gallons of Gas Used
10	0.5
20	1
40	2
80	4

As the number of miles doubles, the number of gallons _____.

doubles quadruples stays the same

So the relationship between miles traveled and gas used is _____.

proportional nonproportional

Day 5
8th

Lesson #5

1. Kinetic energy is the energy of (motion / position).

2. Which two factors are related to kinetic energy?

   mass volume velocity magnetism

3. Kinetic energy is measured in _____.

   newtons Celsius joules kilowatts

4. Write **T** for *true* or **F** for *false*.

   _____ All moving objects have kinetic energy.

   _____ Kinetic energy is dependent on mass but not velocity.

   _____ If velocity increases, kinetic energy increases.

5. Which formula represents how mass and velocity are related to kinetic energy?

   $F = m/A$ $D = m/V$ $S = d/t$ $KE = \frac{1}{2} mv^2$

6. What is true about kinetic energy?

   A) Kinetic energy increases as an object's mass decreases.
   B) Kinetic energy is proportional to the mass of an object.
   C) As velocity increases by x, kinetic energy increases by x^2.
   D) both B and C

7. The table shows two bowling balls that are traveling at the same speed.

Bowling Ball	Mass (kg)	Kinetic Energy (J)
A	3	200
B	6	?

   The masses of the two objects differ by a factor of _____.

   Therefore, the kinetic energy of bowling ball B is _____ J.

8. True or False?

   _____ Kinetic energy is proportional to an object's mass.

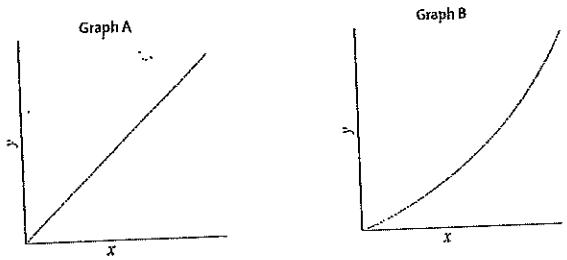
9. When velocity changes by a factor of 5, kinetic energy will change by a factor of _____.

10. A hockey puck is moving across the ice at 20 km/hr. After a slap shot toward the goal, its velocity increases to 60 km/hr. By what factor has the velocity changed? _____

    If the kinetic energy of the hockey puck before the slap shot was 64 J, what is the kinetic energy of the hockey puck after the slap shot? _____ J

11. If two objects are traveling at the same rate, the object with (more / less) mass will have more kinetic energy.

12. For each statement, indicate whether it describes graph **A** or **B**. If it describes both graphs, write **C**.



_____ The variable y changes at the same rate as x.

_____ As x changes, the change for y is not constant.

_____ As x increases, y also increases.

_____ This graph shows the relationship between velocity and kinetic energy.

_____ This graph shows the relationship between mass and kinetic energy.

13. What is the relationship between kinetic energy and velocity?

    A) An object's kinetic energy decreases as its velocity increases.
    B) When velocity changes by x, kinetic energy changes by x^2.
    C) As an object gains velocity, it tends to increase in mass.
    D) There is no relationship between kinetic energy and velocity.

14. Which of these do scientists and engineers use to show relationships among variables and to predict what will likely happen?

    A) probability
    B) formulas and equations
    C) ratios and proportions
    D) all of these

Day 6
8th

Lesson #6

What Is a Wave?

A **wave** is a disturbance that transfers energy from one place to another. When a pebble falls into still water, it creates a disturbance. A repeating pattern of motion carries the disturbance outward in waves.

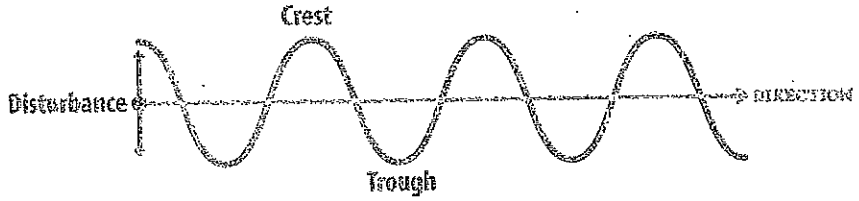
A wave transfers energy, not matter. Although the ripples move away from the disturbance, the water is moving up and down, not outward. As each particle of water moves, it transfers energy to the particles around it. Each particle then returns to its original position. Only the energy moves away from the disturbance.

Waves can be classified by how they travel, and scientists use models to show this.

Model A shows a transverse wave. In a **transverse wave**, the disturbance moves perpendicular to the direction the wave is traveling. As the disturbance oscillates (vibrates) in an up-and-down motion, the wave moves in a horizontal direction.

When the disturbance vibrates up, the wave forms a crest. The **crest** is the peak of a wave. As the disturbance vibrates down, the wave forms a trough. The **trough** (trôf) is the valley of the wave.

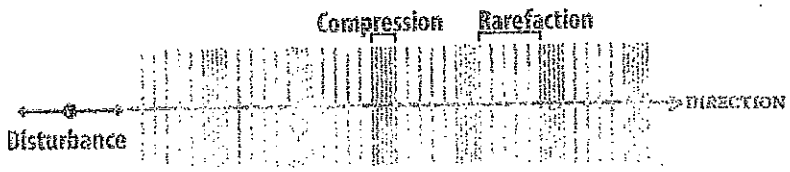
Model A



Model B shows a compression wave, also known as a longitudinal wave. In a **compression wave**, the disturbance moves parallel to the direction the wave is traveling. The particles vibrate back and forth in the same direction the wave is moving.

As the disturbance moves forward, matter is compressed. Notice the areas where the particles are closest together. This region is known as a **compression**. When the disturbance moves backward, the particles spread out. This region is known as a **rarefaction**. The particles then return to their original position where they are neither compressed nor spread out.

Model B

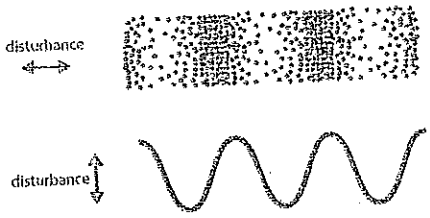


1. Complete the statement.

   A wave is a disturbance that transfers (energy / matter) from one place to another.

2. On the diagram below, label one **crest** and one **trough**.

3. Label each wave model as **transverse** or **compression**.



_____

_____

4. Each model above has an arrow showing the direction of the disturbance. Draw an arrow below each wave showing the direction energy is travelling.

5. True or False?

_____ In all waves, the energy moves away from the disturbance.

_____ In all waves, particles of matter move away from the disturbance.

In the text, underline the sentences that support your answers to the items above.

6. Write **T** if the statement describes a *transverse wave*, **C** for *compression* wave, or **B** for *both*.

_____ has crests and troughs

_____ has compressions and rarefactions

_____ caused by a disturbance moving parallel to the direction of the wave

_____ caused by a disturbance moving perpendicular to the direction of the wave

7. What is the relationship between mass and kinetic energy?

A) When mass changes, there is no change in kinetic energy.
B) When mass changes, kinetic energy changes by the same factor.
C) When mass increases, kinetic energy decreases.
D) There is no relationship between mass and kinetic energy.

8. What is the relationship between velocity and kinetic energy?

A) When velocity changes, there is no change in kinetic energy.
B) When velocity changes, kinetic energy changes by the same factor.
C) When velocity increases by a factor x, kinetic energy changes by x^2.
D) There is no relationship between velocity and kinetic energy.

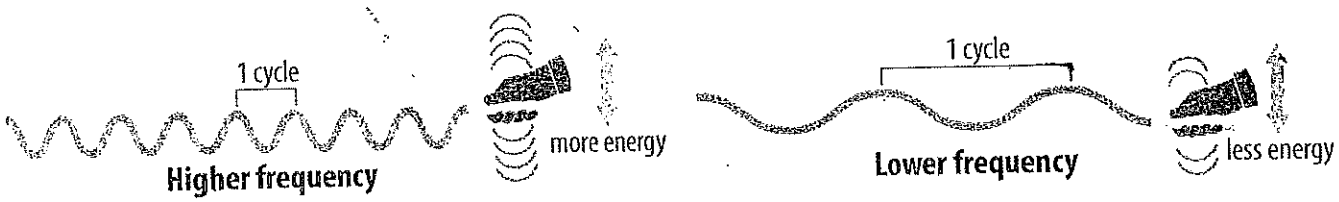
Day 7
8th

Lesson #7

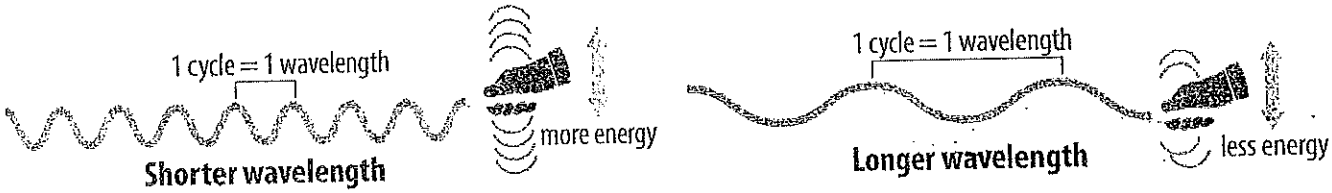
Properties of Waves

A wave can be described by its properties: frequency, wavelength, and amplitude. These properties are related to the disturbance that creates the wave.

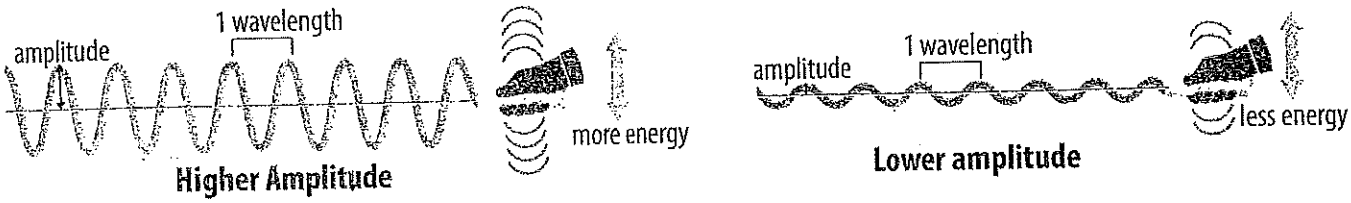
For example, moving the end of a rope up and down creates a transverse wave with a series of crests and troughs. **Frequency** is a measure of how many crests and troughs (how many cycles) occur in one second. If one crest and one trough pass by in one second, this is called one **hertz** (Hz). Moving the rope rapidly, with a great deal of energy, creates a wave with many crests and troughs. Moving the end of the rope slowly, with less energy, creates a wave with fewer crests and troughs in the same amount of time.



The distance from crest to crest or from trough to trough is called the **wavelength**. Wavelength is measured in meters, centimeters, or nanometers. Wavelength and frequency are inversely related. If a wave has a high frequency, it has a short wavelength. If a wave has a low frequency, it has a long wavelength.



A wave's **resting position** is where the rope would sit if there were no disturbance. **Amplitude** is the maximum distance the wave varies from its resting position. It is the distance between the resting position and a crest or the distance between the resting position and a trough. The amplitude of a wave is determined by the energy in the disturbance. A wave with a higher amplitude has more energy than a wave with a lower amplitude.



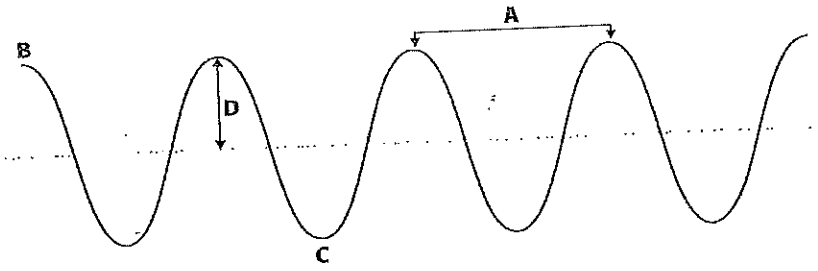
1. Match each term to its letter on the diagram.

_____ amplitude

_____ trough

_____ wavelength

_____ crest



2. The properties of a wave are determined by the _____ that causes the wave.

3. A cycle consists of one _____ and one _____.

   A hertz is the number of cycles that pass by in one _____.

4. True or False?

   _____ One cycle is equal to one wavelength.

5. Frequency and wavelength are inversely related. This means that as the frequency of a wave increases, its wavelength gets (longer / shorter).

6. Amplitude and wavelength are distances. Which of the units below may be used to measure amplitude or wavelength? Choose all that apply.

   nanometers millimeters hertz meters joules

7. True or False? If a statement is false, explain why on the line below.

   _____ A wave is a disturbance that transfers matter and energy from place to place.

   _____ In a transverse wave, the wave moves perpendicular to the disturbance.

   _____

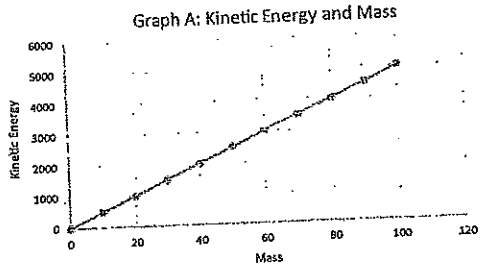
8. What does a graph of mass and kinetic energy tell us?

   A) Mass and kinetic energy are proportional.

   B) As mass increases, kinetic energy increases.

   C) The two variables are increasing by the same factor.

   D) all of these



Day 8
8th

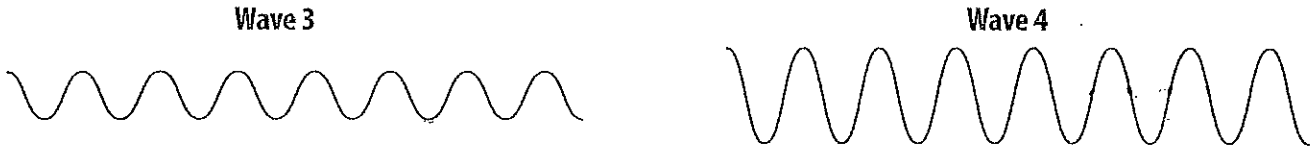
Lesson #8

Energy, Frequency, and Amplitude

The amount of energy in a wave is proportional to the frequency of the wave ($E \propto f$). If the frequency of a wave is doubled, the wave delivers twice as much energy in the same amount of time. If the frequency of the wave is cut in half, the wave delivers half as much energy in the same amount of time.

Wave 2 has twice the frequency of Wave 1. It also has twice as much energy.

As the amplitude of a wave increases by x, the energy of the wave increases by x^2 ($E \propto A^2$). This means that if the amplitude is doubled, the energy of the wave will be four times (2^2) as great. If the amplitude is tripled, the energy of the wave will increase by a factor of nine (3^2). If the amplitude is cut in half, the energy of the wave will be one-fourth ($1/2^2$) as great.



Wave 4 has twice the amplitude of Wave 3. It has four times as much energy.

1. Which of these describes the relationship between energy and a wave's frequency?

   A) Frequency and energy are proportional.

   B) As frequency increases, energy increases.

   C) The two variables increase by the same factor.

   D) all of these

2. Which statement describes the relationship between energy and a wave's amplitude?

   A) As amplitude increases, energy increases.

   B) Energy and amplitude are proportional.

   C) If amplitude doubles, the energy of the wave quadruples.

   D) both A and C

3. (Amplitude / Frequency) has a greater effect on the energy of a wave.

4. The diagram shows two waves with the same amplitude. For each statement, decide if it describes wave **A** or wave **B**.

_____ has the higher frequency

_____ has the longer wavelength

_____ has more energy

5. The diagram below shows two waves with the same frequency. Which statement is true?

A) Wave A has greater amplitude and carries more energy.
B) Wave B has greater amplitude and carries more energy.
C) The waves are equal in amplitude and energy.
D) Wave B has greater amplitude, but wave A carries more energy.

6. A compression wave has a frequency of 40 Hz. The frequency is decreased to 10 Hz.

The frequency of the wave has decreased by a factor of _____.

So the the energy of the wave will (increase / decrease) by a factor of _____.

7. A wave has an amplitude of 10 nm. The amplitude is increased to 30 nm.

The amplitude of the wave has increased by a factor of _____.

So the energy of the wave will (increase / decrease) by a factor of _____.

8. True or False?

_____ In all waves, the energy and matter move away from the disturbance.

9. Which statement is true?

A) Velocity affects kinetic energy less than mass does.
B) Velocity and mass affect kinetic energy equally.
C) Velocity affects kinetic energy more than mass does.
D) Velocity and mass have no effect on kinetic energy.

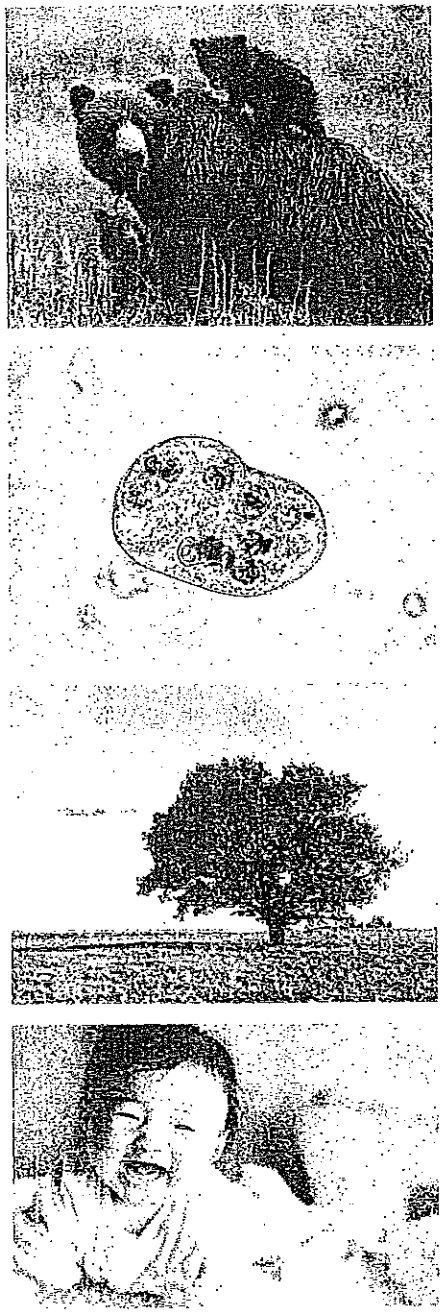
Day 9
8th

Lesson #9

The Characteristics of Living Things

All matter—living and nonliving—is made of elements. The human body is made of the same elements found in soil. Yet, the human body is living, and soil is not. What determines if something is living? Science has identified the characteristics of living things. And every living thing has them all.

- **Living things are made of cells.** Unicellular organisms are made of only one cell. Multicellular organisms are made of many cells. In more complex organisms, cells work together to form tissues. Tissues work together to form organs, organs work together to form systems.
- **Living things respond to stimuli.** A stimulus can be light, sound, heat, or pressure. Or it can be something else. Every living thing senses and responds to stimuli. A worm contracts its body when touched. Human skin gets goose bumps when it is cold. A plant may sense light and grow in the direction the light is coming from.
- **Living things must maintain a stable internal condition.** This is called *homeostasis* (hō mē ō stā səs). An organism must have a consistent internal environment even if the outside environment changes. For the body's cells, conditions such as body temperature should change as little as possible.
- **Living things can reproduce.** To reproduce means to create offspring, or more of the organism's own kind. Reproduction happens in different ways, based on the type of organism. For example, bacteria split in two. Trees produce seeds that grow into saplings. Ducks lay eggs that hatch ducklings. When living things reproduce, they pass on their traits. This is known as *heredity*.
- **Living things use energy.** All of life's activities, from hunting food to sleeping and breathing, require energy. For all organisms, obtaining energy involves some sort of food. Some living things make their own food. These organisms are called *autotrophs* (ȯ tə trōfs). Organisms that cannot produce their own food are called *heterotrophs* (he tə rō trȯfs). To get energy, heterotrophs consume other organisms.



All living things share certain characteristics.

1. The prefix *homeo-* means "same" or "similar." The word *stasis* refers to the "state or condition" something is in. Homeostasis is the ability of living things to maintain a (changing / constant) internal environment.

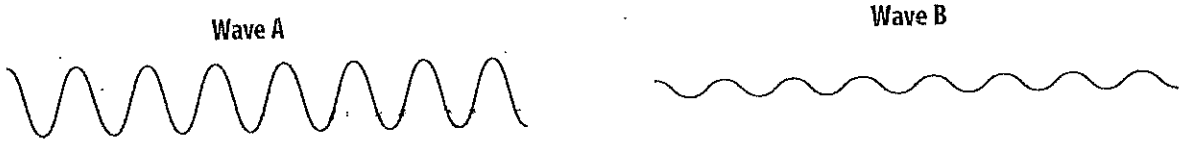
2. The characteristics of living things are listed below. Match each characteristic with its example.

_____ made of cells	A) A sunflower bends toward sunlight.
_____ responds to stimuli	B) Bacteria multiply by splitting into two.
_____ maintains homeostasis	C) A dog pants on a hot summer day.
_____ reproduces	D) An antelope runs across the savanna.
_____ uses energy	E) A microscope reveals small chambers in a slice of cork.

3. All organisms must obtain energy to live. Choose the correct terms.

   (Autotrophs / Heterotrophs) consume other organisms, while (autotrophs / heterotrophs) produce their own food.

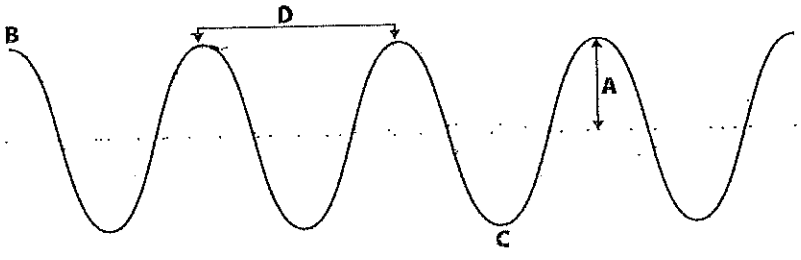
4. The amplitude of wave A is 4 times larger than wave B. Which statement is true?



   A) Wave B has more energy.
   B) Wave A has 4 times more energy than wave B.
   C) Wave B has 4 times more energy than wave A.
   D) Wave A has 16 times more energy than wave B.

5. Match each term to its letter on the diagram.

_____ amplitude
_____ trough
_____ wavelength
_____ crest



6. True or False?

_____ In all waves, matter moves away from the disturbance.

Day 10
8th

Lesson #10

1. A wave is a disturbance that transfers (energy / matter) from one place to another.

2. A compression wave is also known as a _____ wave.

3. Write **T** for *transverse wave* and **C** for *compression wave*.

   _____ The disturbance is perpendicular to the direction energy is traveling.

   _____ Particles of matter vibrate back and forth in the same direction as the wave.

4. Kinetic energy is proportional to the (mass / velocity) of an object.

   The energy of a wave is proportional to the (amplitude / frequency) of the wave.

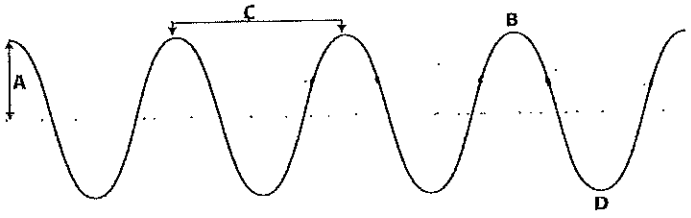
5. Identify each characteristic of the wave.

   A) _____

   B) _____

   C) _____

   D) _____



6. Match each term with its definition.

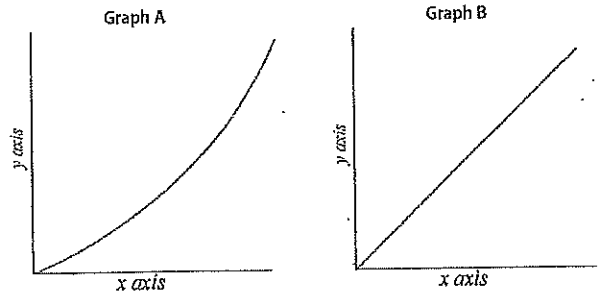
   A) amplitude B) frequency C) wavelength

   _____ the distance between two crests or troughs, or two compressions or rarefactions

   _____ the number of wave cycles per second, measured in hertz

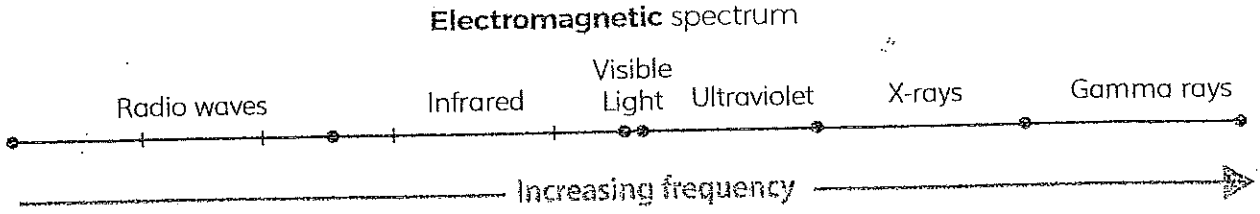
   _____ the height of a wave from resting position to the crest or trough

7. Which graph shows that y is proportional to x? graph A graph B



8. The human body sweats to cool itself. If blood pressure drops, the heart beats faster. The lungs breathe to take in oxygen. These are ways that the body maintains a stable internal environment. Another word for this is _____.

9. Energy from the sun travels through space in electromagnetic waves. Waves from the sun come in different frequencies. This diagram shows the full spectrum of light.



Study the diagram. For each statement, write **T** for *true* or **F** for *false*.

_____ Radio waves have a lower frequency than gamma rays.

_____ Radio waves have more energy than gamma rays.

_____ Visible light waves have a higher frequency than infrared rays.

_____ Visible light waves have more energy than infrared rays.

10. **Pitch** is a characteristic of sound that depends on frequency. Faster vibrations create a higher frequency, and therefore, a higher pitch.

(Wave A / Wave B) has a higher frequency.

So the pitch of wave A will be (higher / lower) than the pitch of wave B.

11. Which of the following is true for all living things?

A) All living things are made of cells that contain genetic material called DNA.
B) Living things have no instinct to respond to their environment.
C) Only heterotrophs need energy.
D) both A and C

12. The table describes a moving object. The velocity of the object changes by a factor of _____.

So the kinetic energy of the object with change by a factor of _____.

Velocity (m/s)	Kinetic Energy (J)
10	10
30	?

After the change in velocity, the kinetic energy of the object will be _____ J.

13. Complete the statement.

(Mass / Velocity) has a greater effect on kinetic energy.