Alternative Method of Instruction
Middle School – 8th Grade
Day 4

Name: _____

Name: _____

Student CP Activity 10

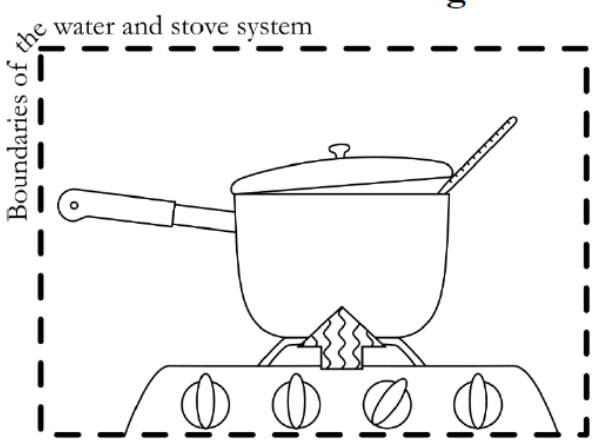
Predicting Energy Changes in Simple Systems

Why?

We are beginning to see the world around us through a physicist's eyes. In our daily lives, energy is being added to or subtracted from objects and systems all the time.
A person takes water from the refrigerator and heats it up on the stove. **What happens to the energy in the water?** A person drops a glass as they are reaching to place it on a high shelf. **What happens to the energy in the glass?** A person drops a bouncy ball on the floor. **What happens to the energy in the bouncy ball?**
These are some of the questions we'll explore in this activity.

As you work through the following questions, be sure to follow your team role(s).

Model 1 – How does adding thermal energy change temperature?



Volume of water = 1 L
Mass of water = 1 kg
Refrigerator temperature = 4 °C
Room temperature = 24 °C
Boiling temperature = 100 °C

We are ignoring energy absorbed by the pan and heat lost to the air during the process of heating the water.

Thermal energy added (kJ)	**Temperature increase** (°C)
42	10
84	20
126	30
168	40
210	50
252	60
294	70
	80

Use the information in Model 1 to answer questions 1 – 12.
Reach agreement with your team before writing down your consensus answers.

1. Read all the words in Model 1.

   a. What is the temperature of the water when you remove it from the refrigerator?

   b. What is the room temperature in the kitchen?

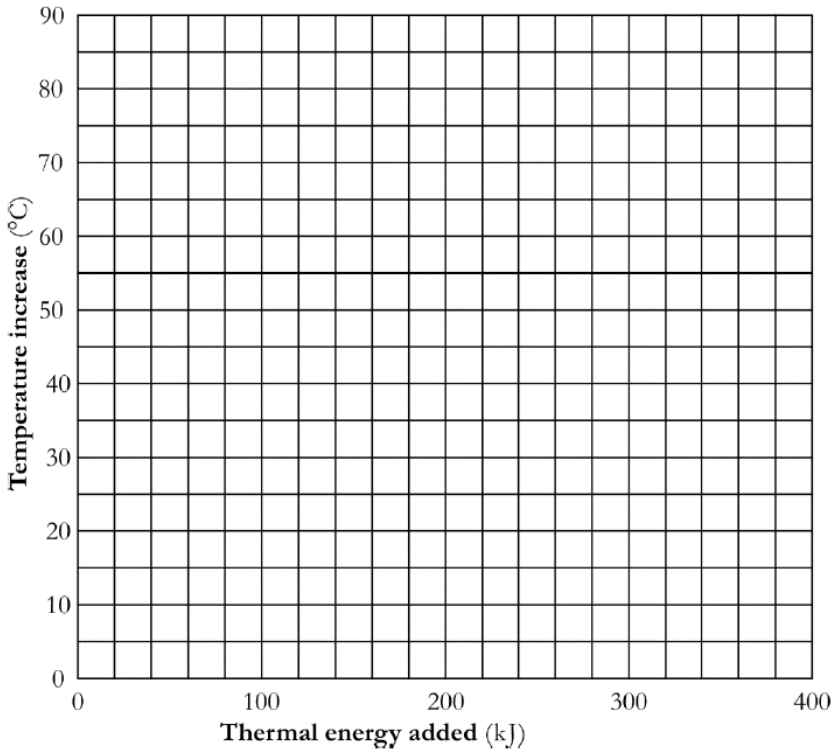
   c. What is the volume of the water?

2. (Circle) the type(s) of energy affecting the water in Model 1.

   Potential Energy Kinetic Energy Thermal Energy Can't tell

3. **Highlight** the boundaries of the system. List the parts (components) of the system outlined in Model 1.

4. **Plot** the data in Model 1. **Connect** the points with a best fit line or smooth curve.



Send spies to check your graph in question 4 with two other teams before you continue.

Read This!

Physicists use many units to describe energy. One common unit is the **joule**. The abbreviation for joule is **J**. We use the term **kilojoule (kJ)** to describe the quantity of energy equal to 1,000 J.

5. Use information from the data table, the graph, and the **Read This!** box to answer the following questions.

a. Write the name and abbreviation of the unit of energy used in Model 1.

b. How much energy must be added to increase the temperature of the water 10°C? Include the correct unit.

c. Does it take the same amount of energy to increase the temperature of the water 10°C more each time? **Explain** your reasoning. Include evidence from Model 1 and from your team's graph in question 4.

6. Fill in the missing data in the data table, using the pattern you described in question 5.

Check your answer to questions 5 and 6 with your teacher before you continue.

7. You want to increase the temperature of the water from **refrigerator temperature** to **room temperature**. **Estimate** the amount of energy it will take. **Show** your reasoning and/or calculations. Include correct units.

8. You want to increase the temperature of the water from **room temperature** to **boiling**. **Estimate** how much energy it will take. Show your reasoning/calculations. Include correct units. Write down any assumptions you are making.

9. Imagine that you are heating water to wash dishes by hand. People usually don't wash dishes at refrigerator, room, or boiling temperature. Discuss with your team. **Estimate** a reasonable temperature for the water when you use it to wash dishes.

a. Write the temperature your team chose: _____ °C

b. **Estimate** the amount of thermal energy needed to heat 1 L of room temperature water to a comfortable washing temperature. Show your reasoning and/or calculations. Include correct units.

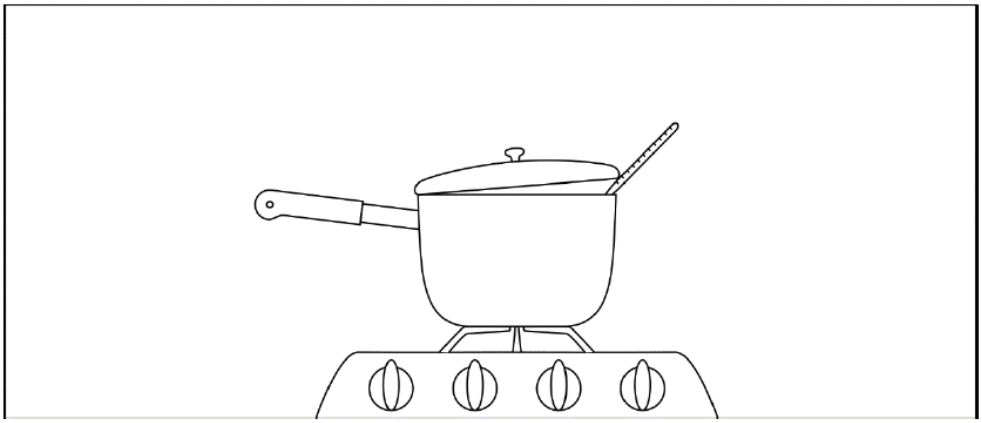
Check your answer to question 9 with your teacher before you continue.

10. You turn off the stove after bringing the water to a boil. You return a few hours later. You notice that the water is now at room temperature.

a. What has happened to the **temperature** of the water during the time you were gone? Has it increased, decreased, or remained the same? Include evidence to support your answer.

b. What has happened to the **thermal energy** contained in the water? Has it increased, decreased, or remained the same? Explain your reasoning.

c. Add **arrows** and **labels** to the sketch below. Show where the thermal energy has moved.



11. You have one liter (L) of water.

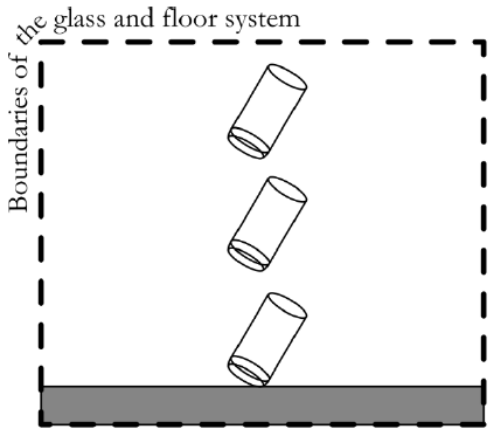
a. How much energy does it take to increase its temperature by 5°C? Show your reasoning/calculations. Include correct units.

b. How much energy does it take to increase its temperature by 1°C? Show your reasoning/calculations. Include correct units.

12. Write one sentence that describes how much thermal energy is needed to increase the temperature of 1L of water by 1°C.

Check your answer to question 12 with your teacher before you continue.

Model 2 – How do potential energy and kinetic energy change when one glass falls to the floor?



What is happening to the glass?	Height above floor (meters)	Potential Energy (J)	Kinetic Energy (J)
Just dropped	2	10	0
	1.5	7.5	2.5
Halfway to the floor	1	5	5
	0.5	2.5	7.5
Hits the floor	0	0	

We are focusing on the vertical movement of the glass and ignoring any horizontal movement.
We are ignoring the internal thermal energy of the glass during its fall, since room temperature is constant.

Use the information in Model 2 to answer questions 13 – 23.
Reach agreement with your team before writing down your consensus answers.

13. Write one sentence to describe what is happening in the diagram in Model 2. Include specific details from the Model.

14. Look closely at the diagram and the data table in Model 2.

a. Circle the **type**(s) of energy affecting the glass.

Potential Energy Kinetic Energy Thermal Energy Can't tell

b. Are the **units** used to measure energy in Model 2 the same as the units used in Model 1? **Explain** your answer.

15. **Highlight** the boundaries of the system. **List** the components of the system outlined in Model 2.

STOP Send spies to check your answer to question 15 with two other teams before you continue.

16. Focus on the column in Model 2 that is labeled **Potential Energy**. Complete the sentence below to describe how the potential energy varies.

As you look from top to bottom of the column, the ***Potential Energy...***

17. Focus on the column in Model 2 that is labeled **Kinetic Energy**. Complete the sentence below to describe how the kinetic energy varies.

As you look from top to bottom of the column, the ***Kinetic Energy...***

18. How do Potential Energy and Kinetic Energy relate to each other? Complete the sentence below.

As the ***potential energy*** *of the glass* ***decreases,*** *its* ***kinetic energy...***

19. Look carefully at the pattern of numbers in Model 2. Discuss with your team. Fill in the missing data in the data table.

20. Fill in the data table below. Calculate the total energy in the glass at each point in its fall.

What is happening to the glass?	**Height above floor** (meters)	**Potential Energy** (J)	**Kinetic Energy** (J)	**Total Energy (PE + KE)** (J)
Just dropped	2	10	0	
	1.5	7.5	2.5	
Halfway to the floor	1	5	5	
	0.5	2.5	7.5	
Hits the floor	0	0	10	

Send spies to check your answers to questions 19 and 20 with two other teams before you continue.

21. Focus on the **Total Energy** column in your data table above. Complete the sentence below to describe what happens to the total energy of the glass **during the time that it is falling**.

As the glass is falling, its total energy…

Read This!

Physicists use the term **Law of Conservation of Energy** to describe how the **total energy of a system remains the same**, even if one type of energy is converted into another type of energy. All the energy in a system can be accounted for by the energy conversions within the system plus any energy movement into or out of the system.

22. **Explain** how the Law of Conservation of Energy applies to the glass **during the time it is falling.** Include evidence from your data table in question 20.

23. Discuss with your team.

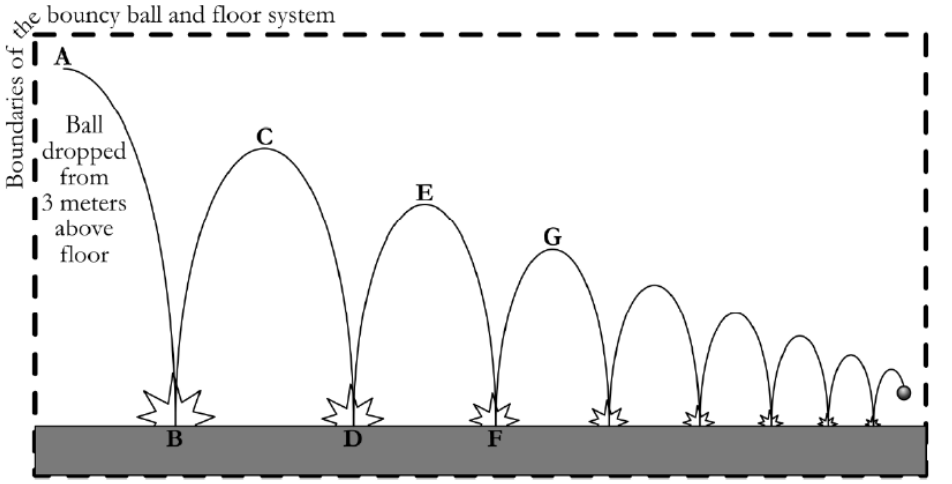
a. Imagine the glass is located **3 m above** the floor. What is the glass's PE?

b. Imagine the glass falls into a hole in the floor. When the glass is located **1 m below** the surface of the floor, what is its PE?

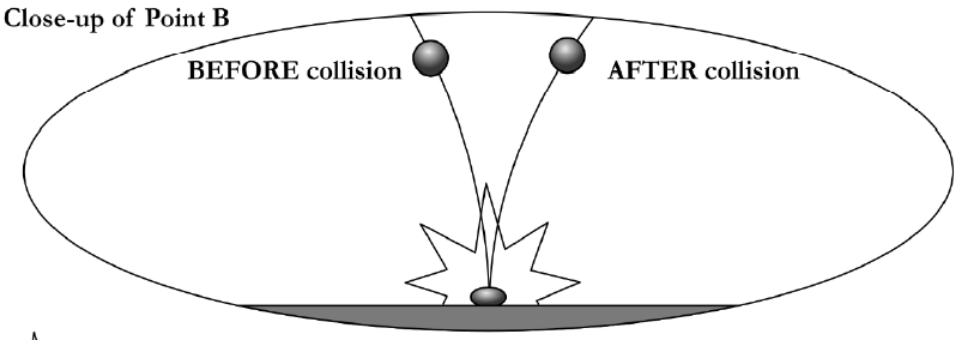
Check your answers to questions 22 and 23 with your teacher before you continue.

Model 3 – How do kinetic energy (KE), potential energy (PE), and thermal energy (TE) change when a ball bounces on a floor?

Diagram: Bouncy ball and floor system



We are focusing on the vertical movement of the ball and ignoring any horizontal movement.



= Some of the ball's KE changes to TE in the ball and floor during the collision

Data Table: Bouncy ball energy changes

Position of bouncy ball	Potential Energy (PE) (10^{-3} J)	Kinetic Energy (KE) (10^{-3} J)
A	600	0
Just before B	0	600
C	480	0
Just before D	0	480
E	384	0
Just before F	0	384
G	307	0

Use the information in Model 3 to answer questions 24 – 35.
Reach agreement with your team before writing down your consensus answers.

24. Read the title of Model 3

a. Circle the **type**(s) of energy affecting the bouncy ball and floor system.

Potential Energy Kinetic Energy Thermal Energy Can't tell

25. What does the symbol  represent in Model 3?

26. Look closely at the **diagram** in Model 3. **List** the components of the system.

27. Look at the **Data Table** in Model 3. Are the **units** used to measure energy in Model 3 the same as the units used in Model 1 and Model 2? **Explain** your answer.

28. Circle points **A**, **C**, **E**, and **G** in the diagram in Model 3. **Describe** one thing that is similar about each of these points.

Check your answer to question 28 with your teacher before you continue.

29. Use information from the **data table** in Model 3 to answer the following questions.

a. What is the ball's **maximum potential energy** (PE) at **Point A**?
Write your answer beside Point A.

b. What is the ball's **maximum PE** at **Point C**?
Write your answer beside Point C.

c. Look at the **diagram**. Describe what happens to the ball between Point A and Point C.

30. Look at the note below the **diagram** in Model 3. What does the symbol  represent in Model 3? Write the entire statement.

31. Use information from the **data table** in Model 3 to answer the following questions.

a. What is the ball's **maximum kinetic energy** (KE) just before the collision at **Point B**?

b. What is the ball's **maximum KE** just before the collision at **Point D**?

32. Complete the sentences below to tell the story of what happens to the ball's energy between Point A and Point D.

a. At Point A the ball's PE is _____ and its KE is _____ .

b. As the ball falls toward Point B, its PE _____ while its KE _____ .
(↑ / stays the same / ↓) (↑ / stays the same / ↓)

c. Just before the collision at Point B, the ball's _____ is zero and its _____ is 600 x 10^{-3} J.
(KE / PE) (KE / PE)

d. During the ball's collision with the floor, some of the ball's KE is converted to _____ .
(PE / TE)

e. After the collision, as the ball rises to Point C, the ball's _____ ↑ while its _____ ↓ .
(KE / PE) (KE / PE)

f. When the ball reaches Point C, its PE is _____ and is KE is _____ .

g. As the ball falls toward Point D, its PE _____ while its KE _____ .
(↑ / stays the same / ↓) (↑ / stays the same / ↓)

33. Use information from the **diagram** and the data table in Model 3 to answer the following questions.

a. Describe what happens to the shape of the bouncy ball as it collides with the floor.

b. Describe how each collision with the floor **changes the ball's thermal energy (TE)**. Explain your reasoning. Include specific data to support your explanation.

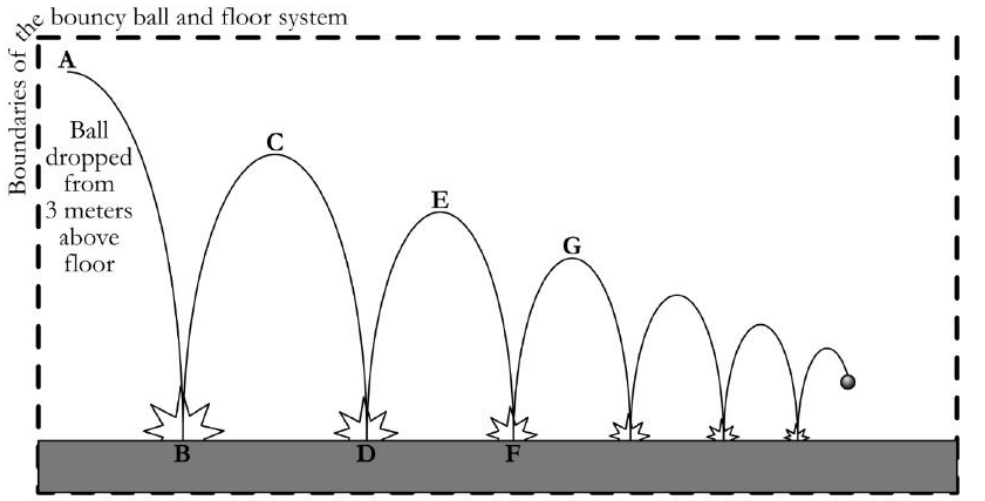
c. Will the **temperature** of the ball decrease, stay the same, or increase after each bounce? Make a prediction with your team.

d. Cite evidence from **Model 1** to support your prediction.

34. **Explain** how the Law of Conservation of Energy applies to the bouncy ball and floor system. Include evidence from your answers to questions 30 - 33.

Check your answer to question 34 with your teacher before you continue.

35. What path will the ball take during its next two bounces?
Draw your team's prediction on the diagram below.



We are focusing on the vertical movement of the ball and ignoring any horizontal movement.

= Some of the ball's KE changes to TE in the ball and floor during the collision

What I Still Wonder…

36. Write one additional question you have about energy changes in a system or about the Law of Conservation of Energy.

Extension Questions

37. Look back at the data in **Model 1** and your graph in question 4.

a. Write the two variables included in the Model and the graph.

b. Is the relationship between these two variables **linear**? Explain your reasoning. Include evidence from Model 1 and/or the graph to support your claim.

c. The symbol we use to represent "change in temperature" is **ΔT** (pronounced "delta tee"). Work with your team to create a mathematical equation that you can use to predict the change in temperature when you know the amount of thermal energy added.

Read This!

We recall that when two variables are **directly related**, the value of one increases as the value of the other increases. When two variables are **inversely related**, the value of one increases as the value of the other decreases.

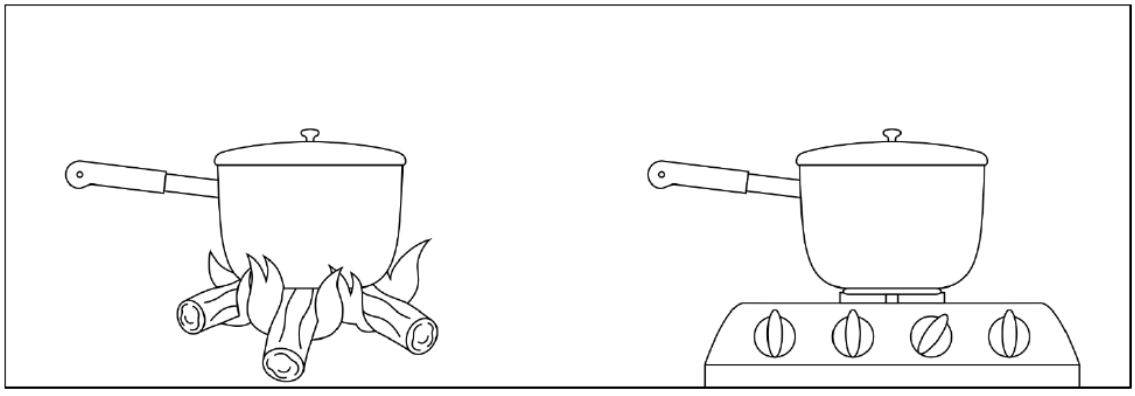
d. Would you classify the relationship between Temperature and Thermal Energy as **direct** or **inverse**? Explain your answer.

38. Imagine heating 1 L of water over a campfire and 1 L of water on an electric range.

a. Which method of heating water would be most efficient (faster temperature change)?

b. Draw arrows in the diagram to show where the thermal energy is moving in this system.

c. **Explain** your reasoning. Assume that both the wood fire and the electric range element release about 2 kJ of thermal energy each second.



39. Look back at the information in **Model 2**. Focus on the information about the glass as it hits the floor and then breaks into pieces.

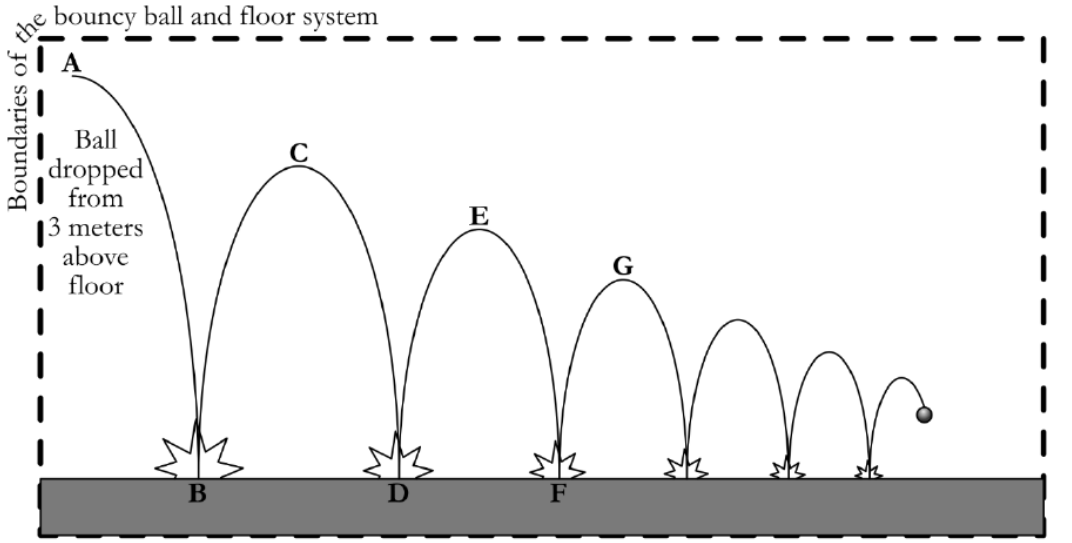
a. What is the **KE** of the glass as it hits the floor?

b. Discuss with your team. When the glass hits the floor, it breaks into pieces and then the pieces stop moving. What is the KE of the glass now? Explain your answer.

c. Describe how your team thinks the Law of Conservation of Energy might still apply to the glass system.

40. Imagine you are placing the glass on a low shelf. You accidentally drop it from a starting **height of 0.5m.** Will the glass be more or less likely to break than the glass in **Model 2**? Explain your reasoning.

41. Imagine that you drop the bouncy ball from a **height of 1.5 meters** instead of 3 meters. What path will the ball take? **Draw** a dotted line on the diagram below to show your team's prediction.



We are focusing on the vertical movement of the ball and ignoring any horizontal movement.

= Some of the ball's KE changes to TE in the ball and floor during the collision

SOCIAL STUDIES – 8TH GRADE

Name: _____

Lesson 4

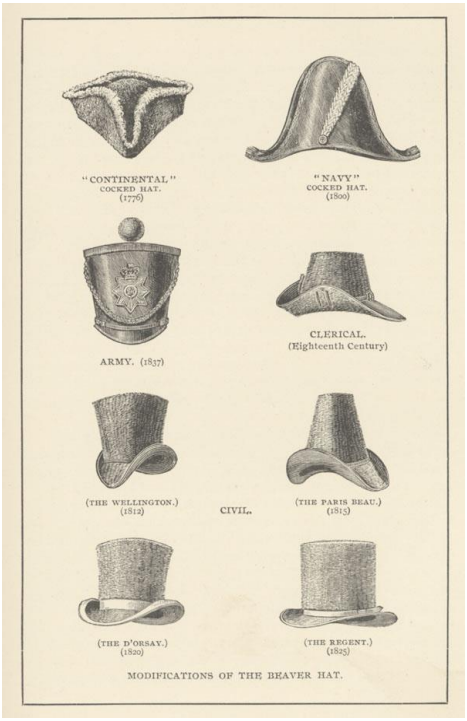
Subject: Exploring US History through Material Culture: What can we learn from material culture in history?

Objective: Students will explore the concept of material culture and its significance in understanding US history. They will learn how material artifacts and objects reflect the values, beliefs, and daily life of people from different historical periods.

Exploring US History through Material Culture:

The origin of everyday objects is a topic that often goes unnoticed in our busy lives. We rarely stop to ponder how our basic possessions, such as pens, chairs, or light bulbs, came into existence. However, these seemingly ordinary objects are vital components of our daily routines. Some objects, like food, water, and shelter, are undeniably essential to sustaining life, ensuring our survival and well-being. Beyond the necessities, there are various items that contribute to making life enjoyable, like books, art, music, and recreational gadgets. Objects hold significant cultural and historical value, providing insights into people's lifestyles, beliefs, and traditions throughout different periods and societies. By studying objects, also known as material culture, we can gain a deeper understanding of our past. We can study items such as Native American points and arrowheads, conestoga wagons, and beaver pelt hats to learn about basic human needs as well as luxury items of the time period.

Below you can see these everyday and unfamiliar objects and contemplate the meanings of these objects to explore the form, function, and history of objects.



Beaver hat. (2023, March 4). In *Wikipedia*. https://en.wikipedia.org/wiki/Beaver_hat

Native American point “arrowhead”

Conestoga wagon. (2023, June 19). In *Wikipedia*. https://en.wikipedia.org/wiki/Conestoga_wagon

1. What can objects tell us about the past?

_____
_____
_____
_____

2. What kinds of relationships exist between human beings and the objects they possess?

_____
_____
_____
_____

3. What do these artifacts tell us about the people who used them?

_____
_____
_____
_____

b. How might these artifacts differ from similar objects used today?

_____
_____
_____
_____

c. How might the study of material culture change our perception of historical events and figures?

_____
_____
_____
_____

ENGLISH LANGUAGE ARTS – 8TH GRADE

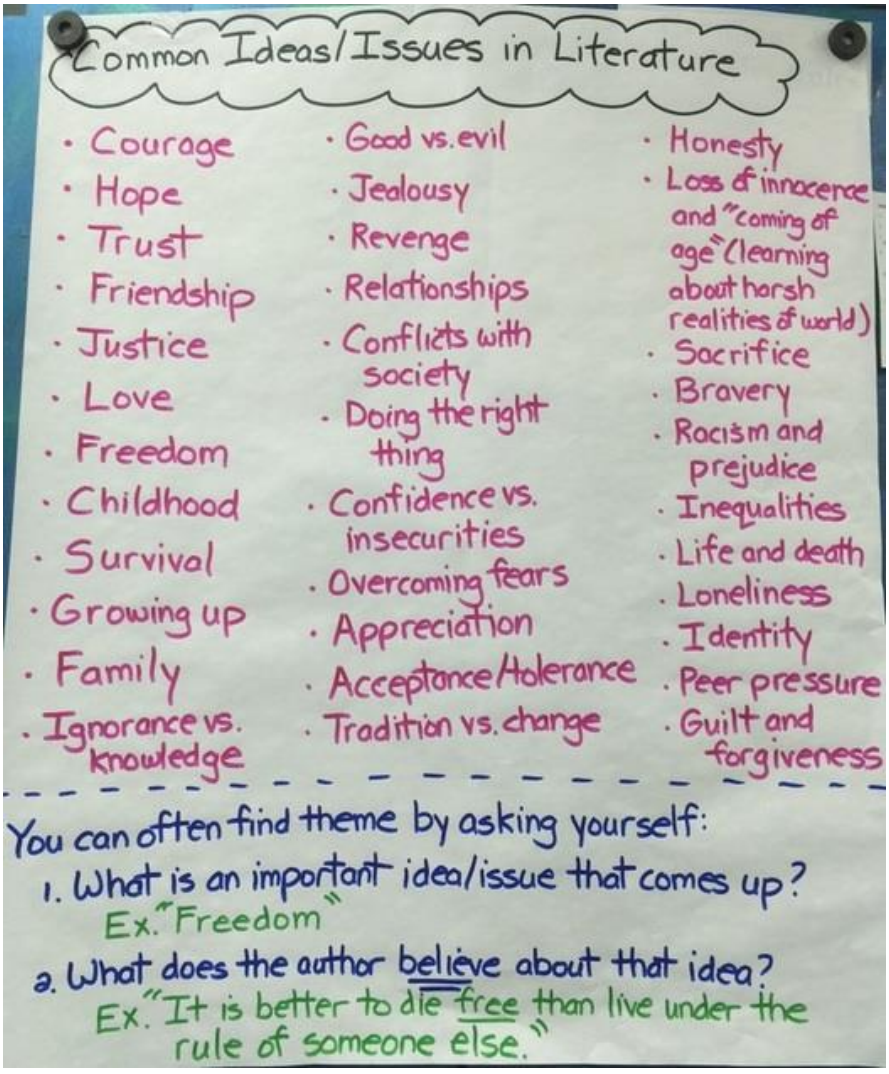
Name: _____
8th Grade ELA
AMI Day #4
Assignment

Theme Playlist through Lyrics:

For today's assignment, you will create a playlist of songs to create a theme that you want.

Directions: Today you will create a playlist of music around a specific theme that you select. You will choose a theme that is important to you in your life or one that you want to create. It could be a theme in a book you are currently reading, a theme of your choice, or one that resonates with you in your life right now, or even one that you want for your life right now. Your task is to select 10 songs that all center sound on a similar theme along with a rationale for the theme you selected.

Theme Selected: _____
Examples of Themes:



Playlist of 10 Songs Within Theme:
(Song Title and Artist Name + 1 sentence rationale for how it fits the theme)

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____

Rationale for Theme Selected: (Must be 2 paragraphs in length)

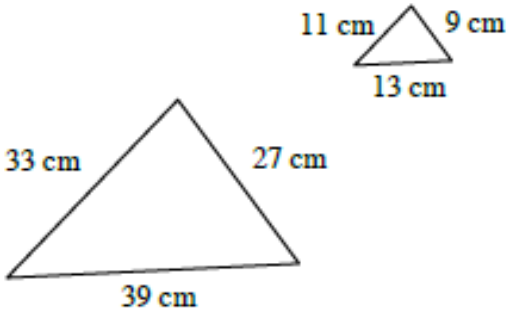
Name: _____

SIMILAR FIGURES

Two figures that have the same shape but not necessarily the same size are similar. In similar figures the measures of the corresponding angles are equal and the ratios of the corresponding sides are proportional. This ratio is called the scale factor. For information about corresponding sides and angles of similar figures see Lesson 4.1.1 in the *Core Connections, Course 2* text or the Math Notes box in Lesson 6.2.2 of the *Core Connections, Course 3* text. For information about scale factor and similarity, see the Math Notes boxes in Lesson 4.1.2 of the *Core Connections, Course 2* text or Lesson 6.2.6 of the *Core Connections, Course 3* text.

Example 1

Determine if the figures are similar. If so, what is the scale factor?

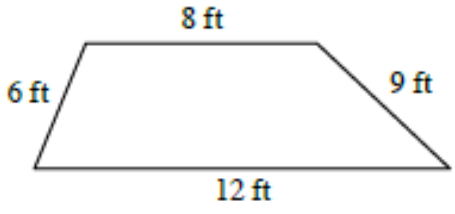


$\frac{39}{13} = \frac{33}{11} = \frac{27}{9} = \frac{3}{1}$ or 3

The ratios of corresponding sides are equal so the figures are similar. The scale factor that compares the small figure to the large one is 3 or 3 to 1. The scale factor that compares the large figure to the small figure is $\frac{1}{3}$ or 1 to 3.

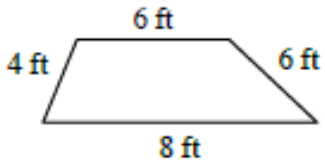
Example 2

Determine if the figures are similar. If so, state the scale factor.



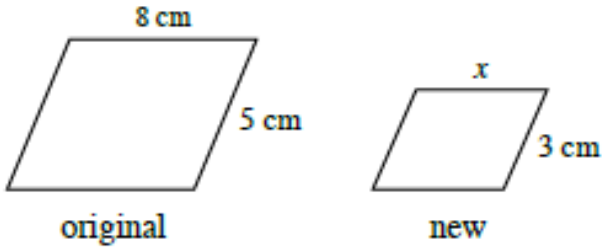
$\frac{6}{4} = \frac{12}{8} = \frac{9}{6}$ and all equal $\frac{3}{2}$.

$\frac{8}{6} = \frac{4}{3}$ so the shapes are not similar.



Example 3

Determine the scale factor for the pair of similar figures. Use the scale factor to find the side length labeled with a variable.



scale factor = $\frac{3}{5}$

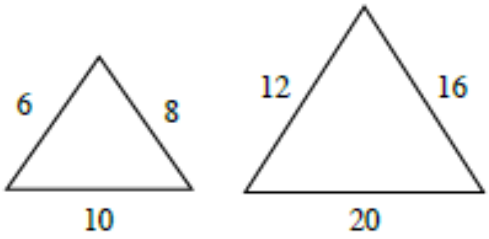
original $\cdot \frac{3}{5} \Rightarrow$ new

$8 \cdot \frac{3}{5} = x; \Rightarrow x = \frac{24}{5} = 4.8$ cm

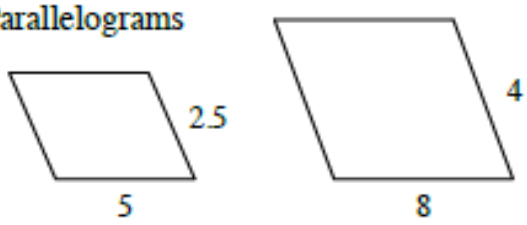
Problems

Determine if the figures are similar. If so, state the scale factor of the first to the second.

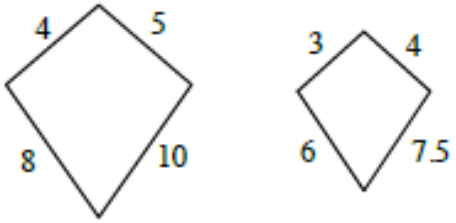
1.



2. Parallelograms

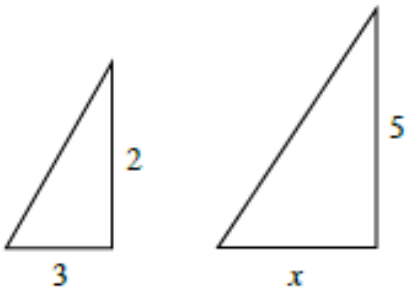


3.



Determine the scale factor for each pair of similar figures. Use the scale factor to find the side labeled with the variable.

4.



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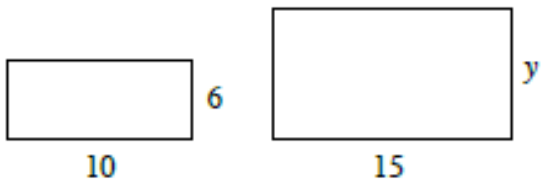

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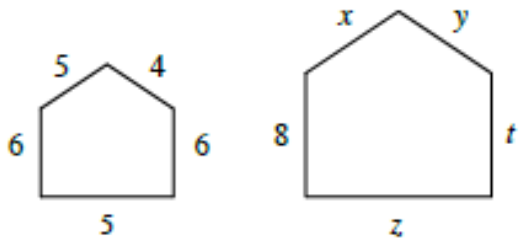
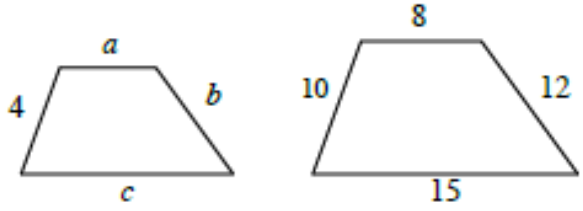


7.



PHYSICAL EDUCATION – 8TH GRADE

Name: _____

AMI Day 4
Choice Day

Directions: Choose Option 1 or Option 2 to complete your fitness for the day.

Option 1: Log on to the Youtube video Pumpkin Smash Workout Game.

- Link: **https://www.youtube.com/watch?v=bJnIf3mYEyQ**
- After you complete the workout in the space below describe what you liked about the workout and what you would do to make the workout better.

Option 2: Build your own workout.

- Think about all the exercises we've done in class or you do on your own and build a 15- 20 min workout. Make sure you include cardio, upper body, lower body and core exercises.
- Below, write the workout you created and completed.

Workout Created by You

If you were going to do this workout again, what would you change?

READING – 8TH GRADE

Name: _____

For each AMI snow day, students should spend 20 minutes reading. Please use the space below to log your reading.

Title: _____

Format (mark one)

_____ Book

_____ Magazine

_____ eBook

_____ Other: _____

Minutes spent reading: _____

ELECTIVES – 8TH GRADE

Student Name: _____

Directions: Choose **ONE** activity from this list of options to complete for each day of AMI work. Please have an adult initial any activities that you complete for AMI days.

Art	Draw or paint a still life picture of something in your home. _____ **initials** _____ **date**	Create a short movie about what you like to do on a snow day _____ **Initials** _____ **date**
Music	Practice your band instrument. _____ **initials** _____ **date**	Listen to your favorite song and sing along, or . . . Compose an original song. _____ **Initials** _____ **date**
Industrial Tech PLTW EbD	Repair something in your home, or . . . Build a fort, either inside your home or with snow outside. _____ **initials** _____ **date**	Create a Rube Goldberg machine, or . . . Build a bridge out of something in your home. _____ **Initials** _____ **date**
Drama	Act our or record a skit with a family member or friend. _____ **initials** _____ **date**	Watch a comedy movie or musical. _____ **Initials** _____ **date**
Family and Consumer Science	Ask your adults about budgeting tips. _____ **initials** _____ **date**	Make yourself a snack using or creating a recipe. _____ **Initials** _____ **date**
World Language / Cultures	Find something in your home from another country and write or tell someone about it. _____ **initials** _____ **date**	List your favorite holiday traditions and ask family members or acquaintances about their origins. _____ **Initials** _____ **date**