Combining Materials
Teacher Facilitation Notes

In General . . .

- Project the slide deck in edit mode–do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.
- For each investigation, assemble the needed materials for each group and place in a central location for ease of distribution.
- Duplicate copies of the data sheets for each student.

Materials Needed Per Group:

Engage:

Craft stick	Plastic spoon	Pot holder
Big Pink Eraser	Sheet of paper	Rock
Piece of styrofoam	Binder clip	Ruler (plastic)
Pencil	Paper towel	Washcloth
Foil pie pan		

Explore/Explain–Tower of Power:

20 small paper cups	2 sheets of construction paper
Masking tape, about 30 cm	Metric ruler
Scissors	

Explore/Explain–Snap It!

Linking cubes (MathLink® Cubes, Lakeshore® Linking Cubes, etc.), 24
Baggie

Elaboration–Saving Humpty Dumpty

Glue	Tape	Scissors

Elaboration Group A Materials

Snap Cubes, 100	Craft Sticks, 20	File Folder, 1
Card Stock, 2 sheets	Felt Squares, 2	Paper, 4 sheets

Elaboration Group B Materials

Card Stock Wheels, 4	Axle holders, 4	Straws, 4
Thick cardboard piece	Chenille sticks, 8	Felt squares, 2
Egg cup from egg carton, 1		

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Elaboration Group C Materials

Straws, 50	Craft sticks, 20	Index cards, 20
Paper clips, 10	Foil, 1 sheet (30-40 cm)	Felt squares, 2
Yarn, 2 meters	Rubber bands, 6	

Elaboration Group D Materials

Cardboard scraps	Craft sticks, 100	Index cards, 20
Foil, 1 sheet (60 cm)	Waxed paper, 100 cm	Rubber bands, 10
Straws, 20	Felt squares, 8	

Other Materials

Student Recording Sheets	Pencils
Student Evaluation Document	Small, stuffed animal
Timer or clock	Empty plastic Easter Egg
Pennies	

Engage

- Place all of the materials needed in the foil pie pan for each group.
- Remind students how to fill out the Anticipation Guide. Depending on students' ability levels, allow them to complete the Guide independently or read each statement aloud to the class.
- Have students watch the video. Ask students to describe the properties of different objects they saw in the video. Remind students of other physical properties they have learned: temperature, mass, magnetism, etc.
- Groups can perform the investigation independently or work together through the steps simultaneously.
- Discuss how an object's flexibility or texture might contribute to its usefulness. Ask the following questions to facilitate the discussion:
  - How are all of the flexible objects alike?
  - Why is being flexible a useful property for some objects?
  - Should all objects be flexible? Explain your answer.
  - Think of one smooth object in your pan. Why do you think it is smooth? Explain your answer.
  - Think of one rough object in your pan. Why do you think it is rough? Explain your answer.
  - When might you want an object or material to be smooth? Rough?
  - Which material in your pan might you use to create or build a wall? A road? A bridge? A house? A pillow? A car? etc.
- Complete the discussion as desired.

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Explore/Explain: Tower of Power

- Tell the students that they are going to be combining materials to create an object for a specific purpose.
- Read through the introduction to the lesson with the students. Go over the the challenge and the criteria for the challenge.
- Ask the following questions:
  - What does the park ranger need us to do?
  - What materials can you use for this challenge?
  - How might you use the cups when building a tower? The construction paper?
  - Do you have enough tape to stick all the cups together? How might you use the tape?
- Give the groups 15 minutes (or less depending on the amount of available time) to create, modify, and test their towers. Circulate among the groups as they work, asking questions and redirecting thinking as needed.
- Take time to have a “Tower Showcase”.
  - Let each group present their tower and tell how they built it.
  - Use a ruler to measure each tower. Have a student place the stuffed animal on the tower and count to 10. Observe what happens.
- Ask questions such as:
  - How did you use the materials you were given?
  - What physical properties of the materials made them appropriate for this task?
- How might you change your design to improve it if you had the time and more materials?

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Explore/Explain: Snap It!

- Students have probably used linking or snap cubes in the past, but you may choose to give them 4-6 minutes to play around with them before beginning the actual lesson.
- Have groups complete the investigation independently. Circulate among the groups as they work, asking questions and redirecting thinking as needed.
- When all of the groups have finished creating and modifying a table made from the snap cubes, lead a class debrief. The following questions may be used to facilitate student understandings:
  - How can the snap cubes be combined to form a square? A rectangle?
  - What did your group do to modify the table from a 3 x 3 table-top to a 3 x 5 table-top?
  - How did you modify your table to make it more stable?
  - What did you do to change your table to a chair?
  - You used cubes to create and modify a table and a chair. Most tables and chairs are not made of snap cubes. What materials are mainly used to make tables and chairs? What properties of these materials make them good to use in making tables and chairs?
- Continue in this manner, stressing that materials are chosen according to their physical properties.

Elaborate: Saving Humpty Dumpty

- Fill a plastic Easter egg with pennies to give it some weight. (This egg will represent Humpty Dumpty.) Tape the pieces together for added strength.
- Have students watch the video about choosing materials. (The video quality is rather poor, but the video gets the idea across in a way that students can really understand.)
- Divide the class into four groups. Discuss the story of Humpty Dumpty as desired.
- Duplicate the wheel and axle parts on cardstock.
- Let the groups work independently to design and construct their objects. Allow them to choose the materials they want to use in their projects. Make sure they tell WHY they are using certain materials and not others.
- When all the groups have completed their projects, have a Design Showcase where they present and explain their projects.
- Ask questions and discuss as desired.

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Evaluate

- Go back over the anticipation guide students completed at the beginning of the lesson. Have them look over their previous answers to see if they stiff agree or disagree with the statements.
- Let students complete the quiz independently.
- Discuss evaluation activities as desired.

Combining Materials

Name: KEY

Evaluation

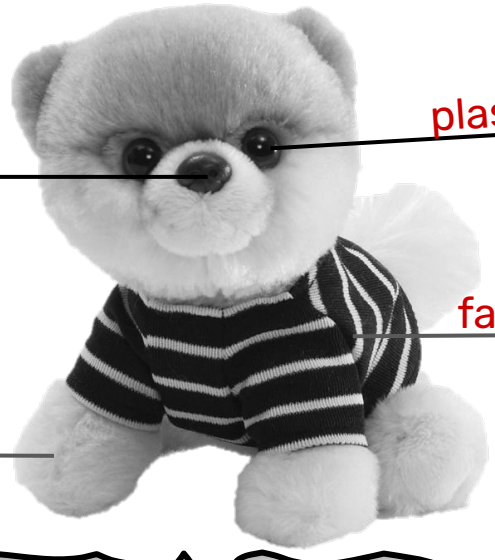
Choose the correct words from the Word Bank to complete each definition.

Word Bank

create	evidence	justify
matter	modify	physical property

1. Anything that has mass and takes up space matter
2. To show to be the right choice justify
3. To make something new create
4. The characteristics of matter or materials Physical property
5. Something that shows another thing is true evidence
6. To change something in some way modify

Study the picture below. Label the object using these words: *plastic, fabric, furry fabric*.



plastic

plastic

fabric

Furry fabric

Combining Materials

Name: KEY

Evaluation

11. Which of these materials would be best for making mittens to keep your hands warm on a cold winter day?

A Paper
B Aluminum foil
C Wool fabric
D Wood

12. The material used to make the top of an umbrella should be–

F Heavy and rough
G Light and waterproof
H Shiny and absorbent
J Colorful and thick

13. Which of the following correctly lists the physical properties of an object?

A A rubber band is stretchy.
B A t-shirt is hard and rough.
C A rock bends easily.
D A craft stick is soft and fluffy.

14. Which **two** materials would be best for making clothing?

A Iron
B Aluminum
C Cotton
D Paper
E Glass
F Wool

Combining Materials

Name: KEY

Evaluation

15. Which of the following physical properties do these two toys have in common?

A Odor

B Size

C Mass

D Texture

16. A student decided to make a spoon maraca so she could play along with here favorite songs. What material would be best for placing inside the maraca to make a shaking noise?

F Cotton balls

G One large rock

H Dry beans

J Rubber bands

17. A student wanted to test how far a toy car would go when leaving a ramp of different heights. He made the ramp out of a piece of paper. When he put the car on it, the ramp sagged and the car wouldn't move. How could the student modify the ramp to make it stable enough for the car to roll down?

A Use a car that weighs less and rolls better.

B Tape it to a stack of books to make it more stable.

C Glue the piece of paper to a piece of thick cardboard.

D Make the ramp a different color so that you can see the car better.

Combining Materials

Name: _____

Engage: Anticipation Guide

Agree	Disagree	Statement
		Different types of matter have different physical properties.
		Materials can be combined to create or modify an object.
		The physical properties of the materials are not important when using them to build a bridge or house.
		Materials can be compared and classified by their physical properties.
		It is unnecessary to observe or test the physical properties of materials as objects are created or modified.

1. What sorting rule did you use to sort the objects into 2 groups?

2. What sorting rule did you use to sort the objects into 3 groups?

3. Which objects are rough?

4. Which objects are flexible (can bend easily)?

In the space below, define *matter* in your own words.

Combining Materials

Name: _____

Explore: Tower of Power

Challenge:

Design and construct a tower to hold an animal 30 cm above the ground for at least 10 seconds to keep it safe from the alligators in a swamp.

Our Tower: Sketch your tower design in the space below.

My Conclusions:

Combining Materials

Name: _____

Explore: Snap It!

Square (4 cubes)	**L-Shape (4 cubes)**	**Rectangle (10 cubes)**
Table (17 cubes)	**Modified Table (23 cubes)**	**Chair (23 cubes)**

My Conclusions:

Combining Materials

Name: _____

Elaboration: Saving Humpty Dumpty

Group A
Wall and Ramp

Design and construct a wall on which Humpty can sit and a ramp that will allow him to go from the top to the bottom of the wall without falling!

Criteria/Constraints

- The wall must be at least 15 cm tall.
- The wall must be free-standing. (No one can hold or support the wall during testing.
- The wall must support Humpty without letting him fall.
- The ramp must be at least 20 cm in length.
- The ramp must allow Humpty to move up and down easily.
- Only the given materials may be used in constructing the ramp and wall. (You do not have to use ALL of the materials.)

Materials

Snap cubes (100 or less)
Craft sticks (20 or less)
File folder (1)
Card stock (2 sheets)
Felt (2 squares)
Paper (4 sheets)
Glue
Tape
Scissors (only as a tool– not in wall or ramp)

Design/Build/Test

- Plan which materials you will use and decide how you will use them.
- Build the wall and the ramp.
- Test the wall by putting Humpty on top of it.
- Can Humpty sit on the wall without falling?
- Attach the ramp to the wall and test it by letting Humpty roll down it from the top to the bottom.

Combining Materials

Name: _____

Elaboration: Saving Humpty Dumpty

Group B
Humpty-mobile

Design and construct a vehicle (car) that can safely carry Humpty from his home to his wall.

Criteria/Constraints

- The Humpty-mobile must roll and safely carry Humpty Dumpty at least one meter.
- The Humpty-mobile must have at least 2 wheels and 1 axle.
- At least three different kinds of materials must be used in constructing the Humpty-mobile.
- Only the given materials may be used in constructing the vehicle.

Materials

Card stock wheels (4)
Axle holders (4)
Thick cardboard piece
Straws (4)
Chenille sticks (8)
Felt squares (2)
Egg cup from egg carton (1)
Glue
Tape
Scissors (only as a tool– not as a part of the vehicle)

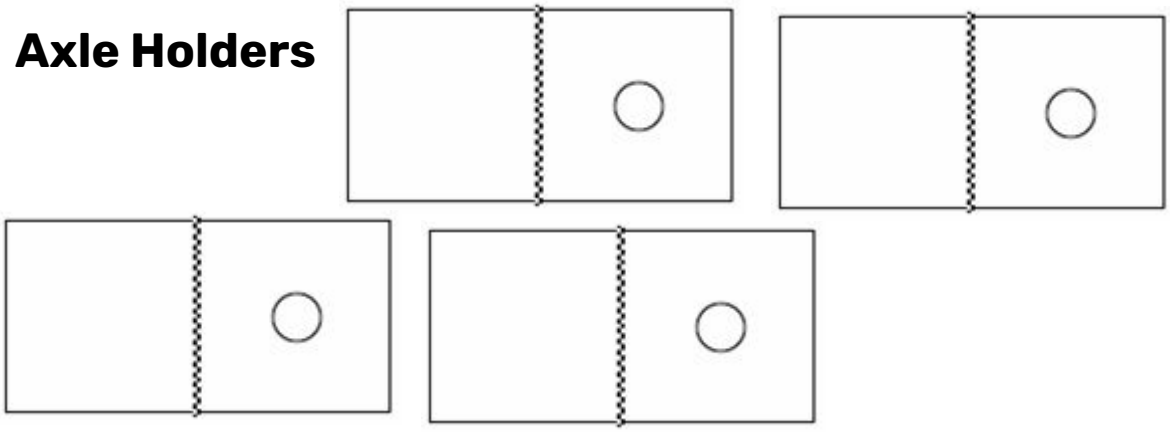
Design/Build/Test

- Plan which materials you will use and decide how you will use them.
- Build the vehicle. Be sure it has a place for Humpty to sit without rolling off of the car.
- Test it at least three times. Make any changes you need as you test it.

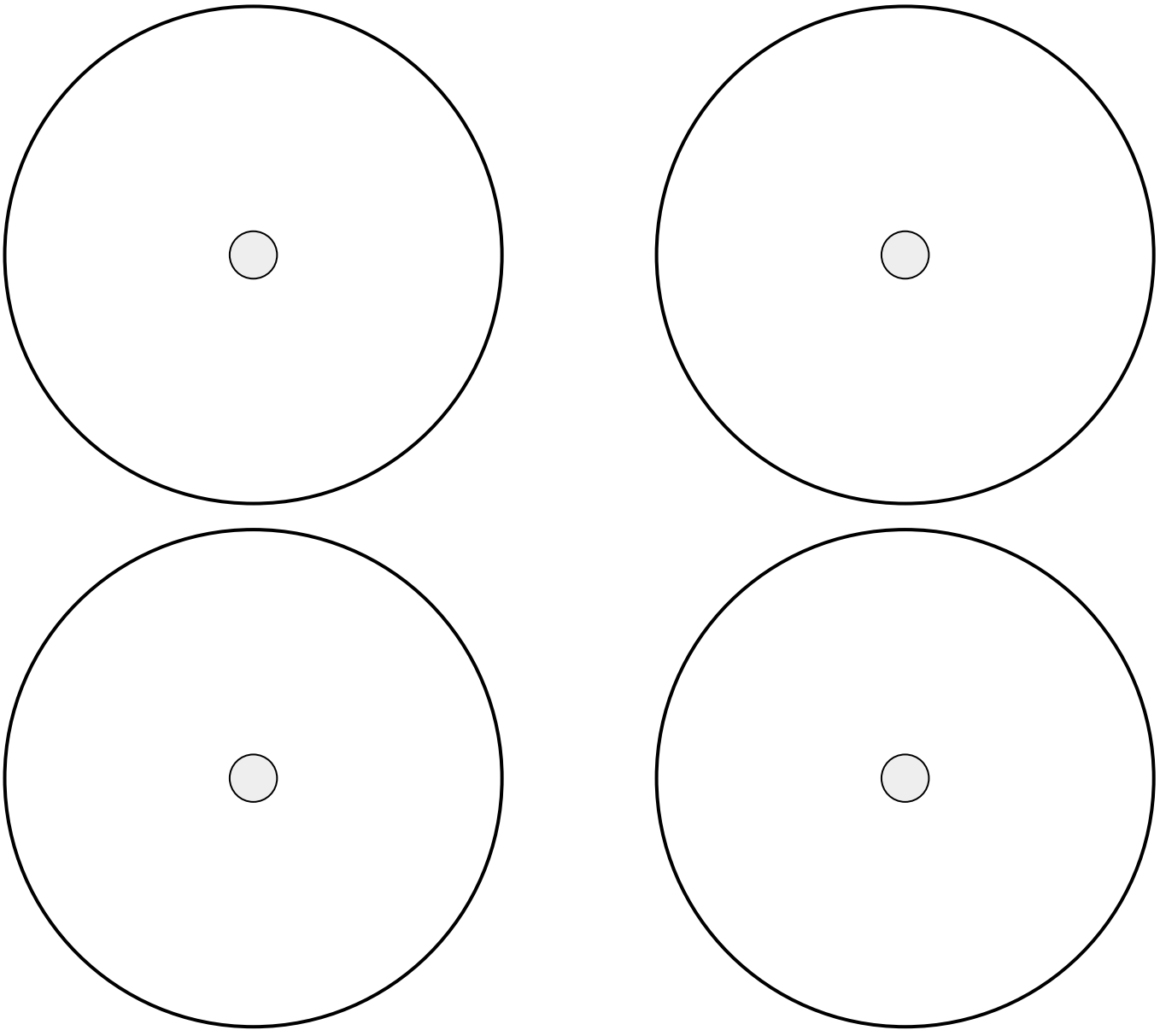
Combining Materials

Elaboration: Saving Humpty Dumpty

Axle Holders



Wheels



Combining Materials

Name: _____

Elaboration: Saving Humpty Dumpty

Group C
Rainbow Bridge

Design and construct a rainbow bridge that Humpty can cross in his humpty-mobile as he travels from his home to his wall.

Criteria/Constraints

- The bridge must be at least 20 cm in length.
- The bridge must be able to support the weight of Humpty as he rides in his Humpty-mobile.
- The bridge must be primarily made of straws.
- The bridge must be free-standing and cannot be held or supported during testing.
- Only the given materials may be used in constructing the bridge. (Not all of the materials need to be used.)

Materials

Straws (50 or less)
Craft sticks (20 or less)
Index cards (20 or less)
Paper clips (10 or less)
Foil (1 sheet)
Felt squares (2)
Yarn (2 meters)
Rubber bands (6 or less)
Glue
Tape
Scissors (only as a tool– not as a part of the bridge)

Design/Build/Test

- Plan which materials you will use and decide how you will use them.
- Build the bridge using your chosen materials.
- Make sure that it can stand by itself without anyone holding it.
- Ask Group B to help you test the bridge by placing their Humpty-mobile on it.
- Make any improvements that are needed.

Combining Materials

Name: _____

Elaboration: Saving Humpty Dumpty

Group D
Humpty's House

Design and construct a house to keep Humpty safe from wind and rain.

Criteria/Constraints

- The house must be large enough for Humpty to fit inside.
- The house must have a doorway through which Humpty can enter.
- The outside of the house must be waterproof.
- The house must be free-standing and cannot be held or supported during testing.
- Only the given materials may be used in constructing the house. (Not all of the materials need to be used.)

Materials

Cardboard pieces
Craft Sticks (100 or less)
Index cards (20 or less)
Foil (1 sheet)
Waxed paper (1 sheet)
Rubber bands (10 or less)
Straws (20 or less)
Felt squares (8)
Glue
Masking tape
Scissors (only as a tool– not as a part of the bridge)

Design/Build/Test

- Plan which materials you will use and decide how you will use them.
- Build the house using your chosen materials
- Make sure that it can stand by itself without anyone holding it.
- Test to make sure Humpty can fit through the door and it is waterproof.
- Make any improvements that are needed.

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