



Simple Machines: Toy Factory

Toys that Move

A LEGO[®] Education Program
Advanced STEAM Program

Toy Factory: Toys that Move

LEGO® Education Simple Machines Program

Elementary STEAM Program Overview:

This outline will provide students with STEAM focused hands on activities to promote 21st century skills as well as design engineering. Each day, students will participate in team building activities, engage in opportunities for physical activity, and receive a briefing for daily challenges aligned to standards. Daily challenges will help students develop skills and knowledge to complete the culminating project, to design a new toy for the toy fair.

| Program at a Glance | | |
|---------------------|--|--|
| Day | Essential Questions | Daily Activities |
| Day 1 | Welcome to the Toy Factory: Toys that Move: Wheels and Axles How are toys made? How do toys move? How can wheels and axles help toys move in different ways? | Principle Model – Wheels and Axles Guided lesson – Toy: Go-carts |
| Day 2 | Toys that Move: More Wheels and Axles How do toys move? How can wheels and axles help toys move in different ways? | Problem Solving Activity: Wheelbarrow Toy: Wobble Animals |
| Day 3 | Toys that Move: Levers How do toys move? What is a lever? Are there different kinds of levers? How can levers help toys move in different ways? | Principle Model: Levers Guided Lesson: Levers Problem Solving Activity: Levers Toy: Catapult Game |
| Day 4 | Culminating Project: Toy Fair How do toys move? How can I use my knowledge of simple machines to create a toy? | Design and build a toy Toy Fair |

Prior to First Day of the Program:

1. Sort the sets. One suggestion is to sort the sets as follows.
 - a. place all the red elements (except the longest beams) in one tray compartment.
 - b. place the longest beams in the bottom of the bin.
 - c. place the yellow elements and the minifigures in another tray compartment.
 - d. place the white and green elements in a third tray compartment.
 - e. place the black weight brick, the tires, the large 40-tooth gears, and the brick separator in the bottom of the bin.
 - f. place all the remaining pieces in the fourth tray compartment.
 - g. because they are not used in every lesson, the yellow rubber bands and the string with ends can be kept in a separate zippered bag and only given out when needed – usually with the pulley lessons.
2. Determine a naming convention for each set.
Suggestions include school initials and a number (Example: Millcreek Elementary kits names could be MES1; MES2; MES3).
3. Write the name of the set on the box.
4. Gather any consumable materials needed for the week.
5. Determine a procedure for when a LEGO® piece is dropped (everyone freeze; say LEGO® down/LEGO® found) and where to place LEGO® pieces if found and does not belong to the finder.

Information for the teacher:

If you are unfamiliar with simple machines levers and wheels and axles, you can find some background information in our activity pack, which is available at https://le-www-live-s.legocdn.com/downloads/MachinesAndMechanisms/MachinesAndMechanisms_Activity-Pack-For-Simple-Machines_1.0_en-US.pdf

Background information for teachers on the topic of simple machines can be found on the following pages of the document listed above:

- General overview of simple machines: page 10
- Wheels and Axles (used in this camp): pages 41-68
- Levers (used in this camp): pages 69-94
- Classroom Management Tips: page 8
- LEGO Element Survey (a list of all the pieces in the set): pages 126-128
- Assessment Tools: page 6

In addition to the background information, the page number for any activity used from the activity pack will be provided in the program document.

Toy Factory: Toys that Move Day 1

Welcome to the Toy Factory

Big Questions:

How are toys made?

How do different toys move?

How can wheels and axles help toys move in different ways?

Materials needed for the day:

- Simple Machine sets
- Building Instruction booklet B
- Chart paper
- Student journals (could be paper stapled together with students creating the outside of the journal using construction paper and other consumable materials)
- Various craft materials
- Cardstock or heavy paper
- Pens
- Crayons
- Pencils
- Markers
- Team badge templates
- Book or videos about toys, inventing toys or familiar toys

| Outline of Day | Tasks | Time | Materials |
|----------------|---|--------|---|
| 9:00 - 10:30 | Introductions | 30 min | <ul style="list-style-type: none">• LEGO® bricks |
| | Establishing Group Rules and Expectations | 15 min | <ul style="list-style-type: none">• Chart paper• Markers• Pens |
| | Team Building Activity | 15 min | <ul style="list-style-type: none">• LEGO® bricks |
| | Morning Huddle | 5 min | <ul style="list-style-type: none">• None |
| | Partner Selection, Team Name and Team Badge | 25 min | <ul style="list-style-type: none">• Varies, based on the activity selected• Team badge templates |

| | | | |
|---------------|--|-----------|---|
| | | | <ul style="list-style-type: none"> • Markers • Pencils • Scissors |
| 10:30 - 10:35 | Break | | |
| 10:35 - 11:25 | Workplace Wellness (physical activity) | 10 min | <ul style="list-style-type: none"> • Varies, based on the activity selected |
| | Design a Journal | 20 min | <ul style="list-style-type: none"> • Student journals (See note in materials section) • Markers • Scissors • Construction paper • Other craft materials |
| | Reading and Wondering | 20 min | <ul style="list-style-type: none"> • Book or videos about toys; toys with wheels |
| 11:25 | Get ready for lunch | | |
| 11:30 - 12:00 | Lunch | | |
| 12:00 - 2:20 | Afternoon Huddle | 5 minutes | <ul style="list-style-type: none"> • None |
| | Challenge 1: Intro to Wheels and Axles | 45 min | <ul style="list-style-type: none"> • Student journals • Simple Machines sets • Student worksheets • Teacher notes • Board or stiff cardboard • Stack of books |
| | Challenge 2: Friction Conditions | 25 min | <ul style="list-style-type: none"> • Simple Machines sets • Board or stiff |

| | | | |
|-------------|-------------------------------------|--------|---|
| | | | cardboard <ul style="list-style-type: none"> Stack of books Different types of material to place on board for friction test (e.g. felt, foil, carpet squares, etc.) |
| | Break | 5 min | <ul style="list-style-type: none"> None |
| | Challenge 3: Guided Lesson: Go Cart | 60 min | <ul style="list-style-type: none"> Student journals Simple Machines sets Markers Crayons Colored pencils Cardstock or paper Scissors |
| 2:20 - 2:30 | Daily Debrief and Wrap Up | 10 min | <ul style="list-style-type: none"> Student journals |

Introductions

Time: 30 minutes

Materials:

- Loose LEGO® bricks

Purpose: For students to get to know each other

Using the LEGO® bricks, have students build a model that shows something they really like to do and one thing they hope to learn during the STEAM program. When time to share, have students say their name and share their model. The teacher can record what the group hopes to learn on a piece of chart paper.

Group Rules and Expectations

Time: 15 minutes

Materials:

- Chart paper
- Markers

Using a piece of chart paper, establish group rules and expectations for the week as a class. You can have students sign the chart paper and then place the rules and expectations in a location that can be reviewed each day.

Team Building Activity

Time: 15 minutes

Materials:

- Loose LEGO® bricks

Explain to students that each day will include some type of team building challenge. Working together is an important skill and just like other skills, we can practice it to get better and better.

Tower Build Remix

Have students work in groups of 4-6 students.

Provide each group with a container of loose LEGO® bricks. Have students work together to build the tallest tower they can that will hold the weight of an object. The object could be a water bottle or a pack of sticky notes. Object needs to be given to each group and needs to be consistent.

- What was challenging?
- How did you overcome the challenge?
- What was successful?
- How did you work together?
- If you were to do this tower build again, what would you change?

Morning Huddle

Time: 5 minutes

Materials: None

Welcome to the Toy Factory! This week we will be exploring how some toys work. Your first task is to complete the following:

- *Determine a partner for training exercises*
- *Work with partner to determine a team name and design a team logo*
- *Design a journal for keeping important records this week*
- *Explore different kinds of toys and toys that move*

Partner Selection, Team Name and Team Badge/Logo

Time: 25 minutes

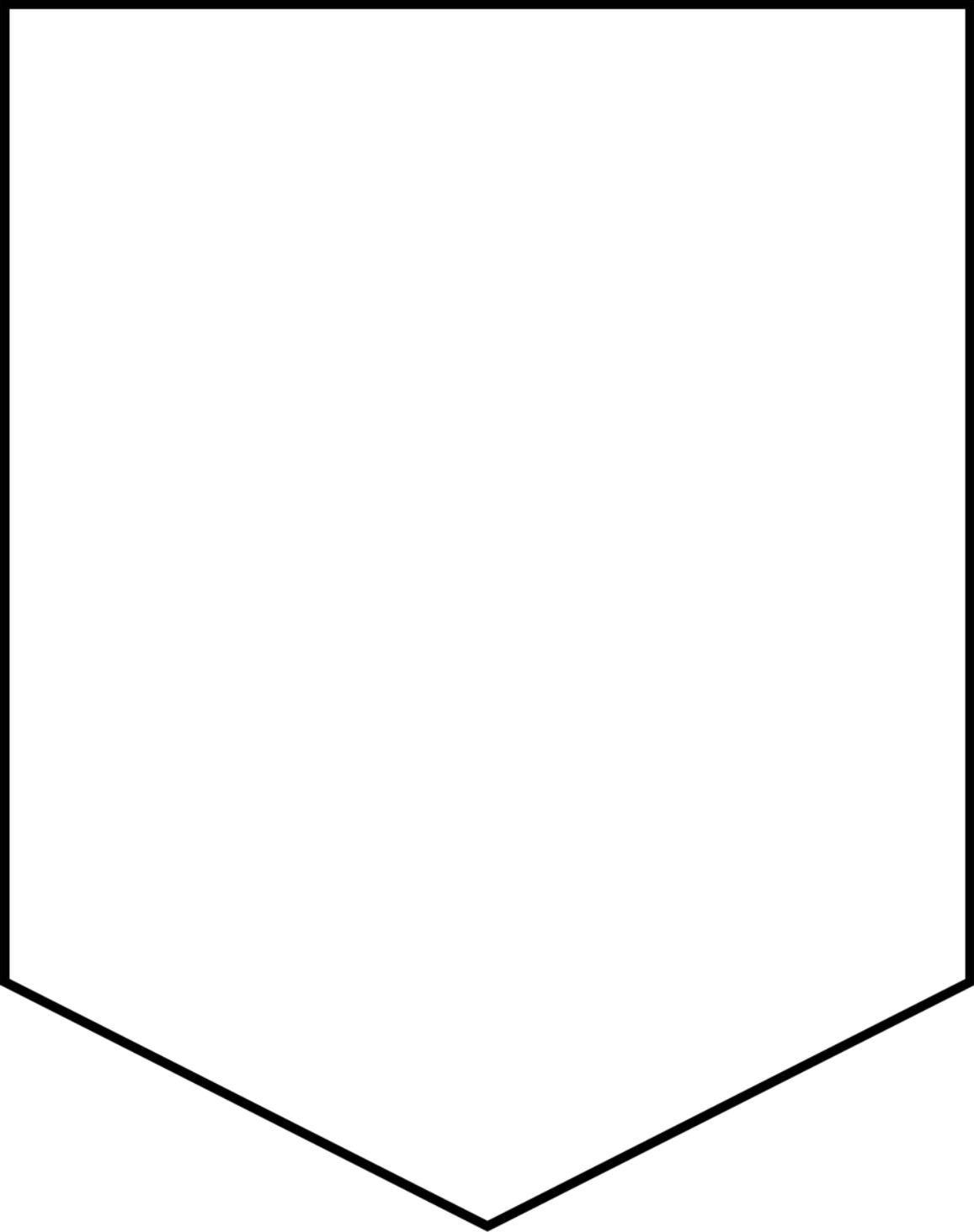
Materials:

- Student journals (see note in materials section)
- Markers
- Scissors
- Construction paper
- Other craft materials

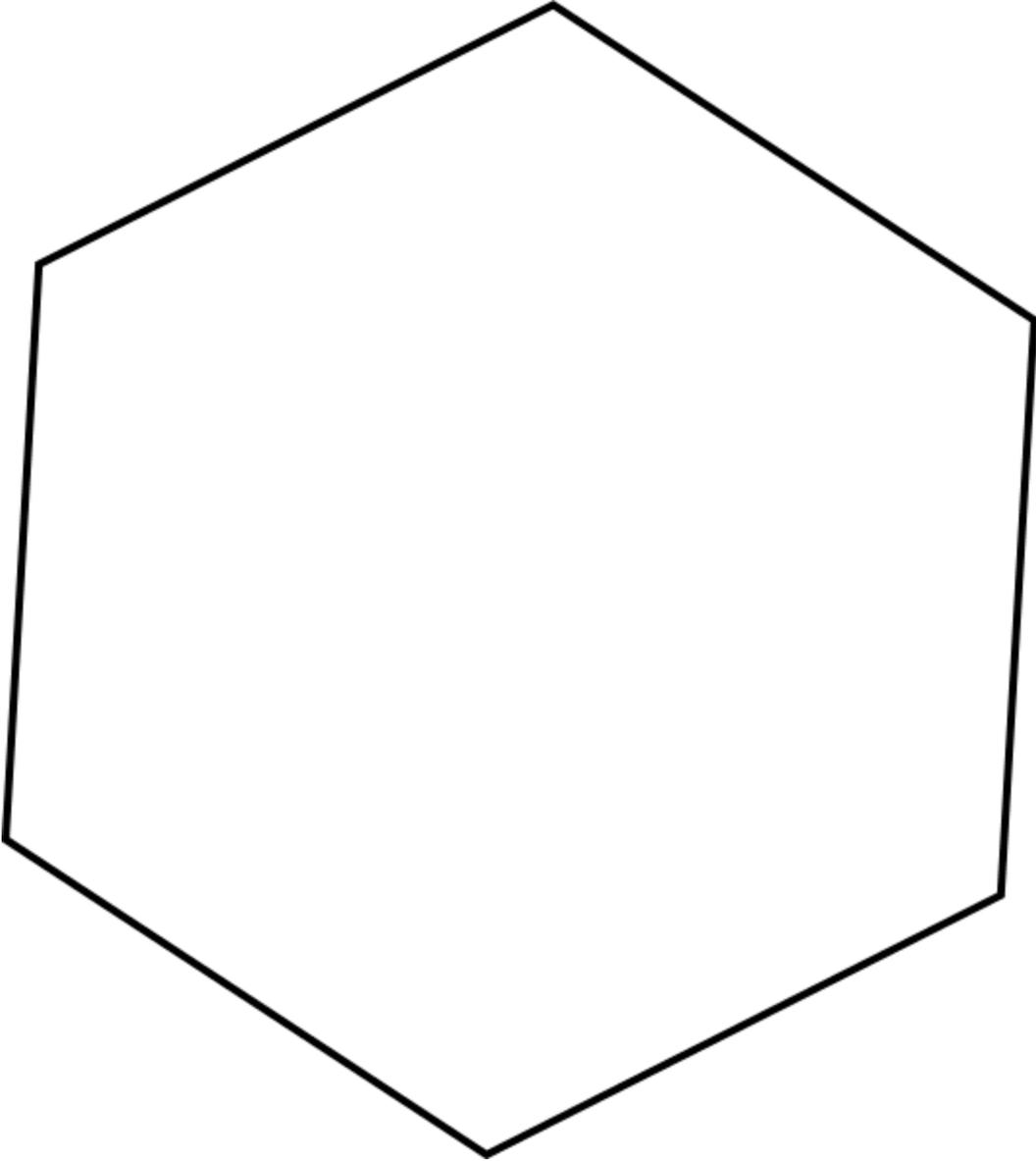
You can use several different activities to help students find a partner to work with for the week. Some ideas can be found through a quick internet search. Once partners have been established, student teams can determine a name for their toy company and design a logo. Students will be designing and building a toy later in the week for a toy fair on Day 4.

While teams are working, assign each group a Simple Machines set to use for the week.

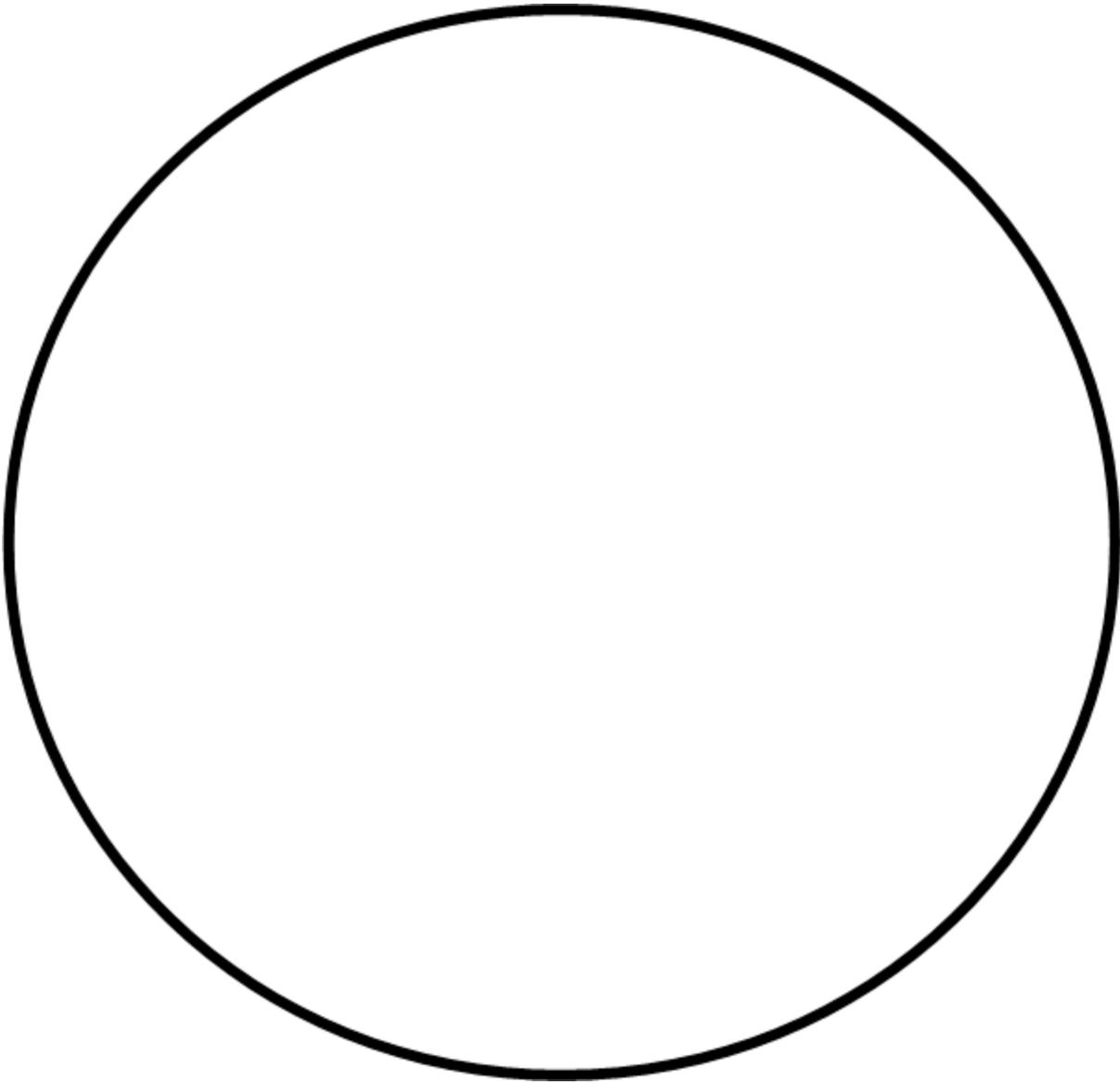
Badge Template



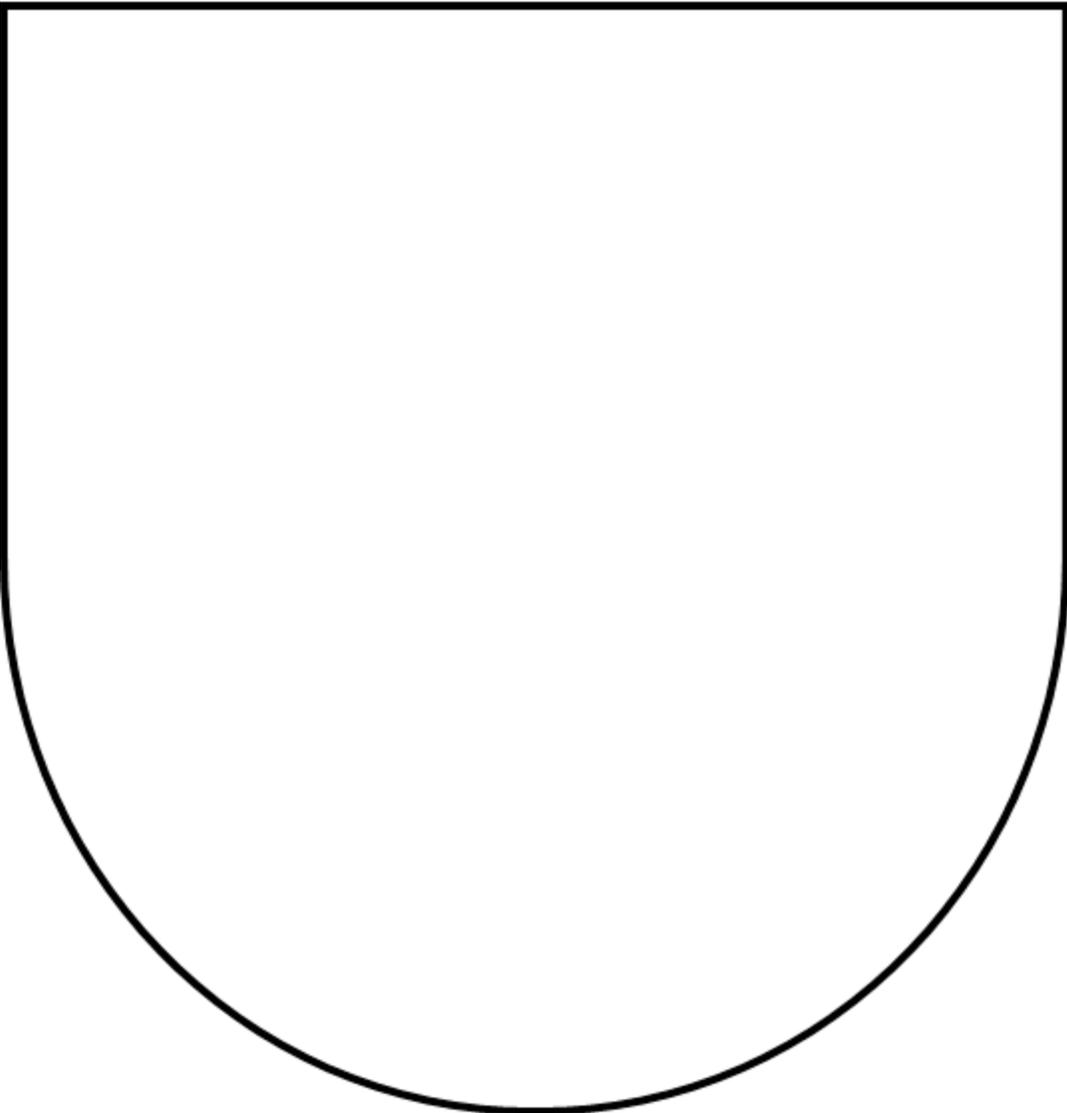
Badge Template



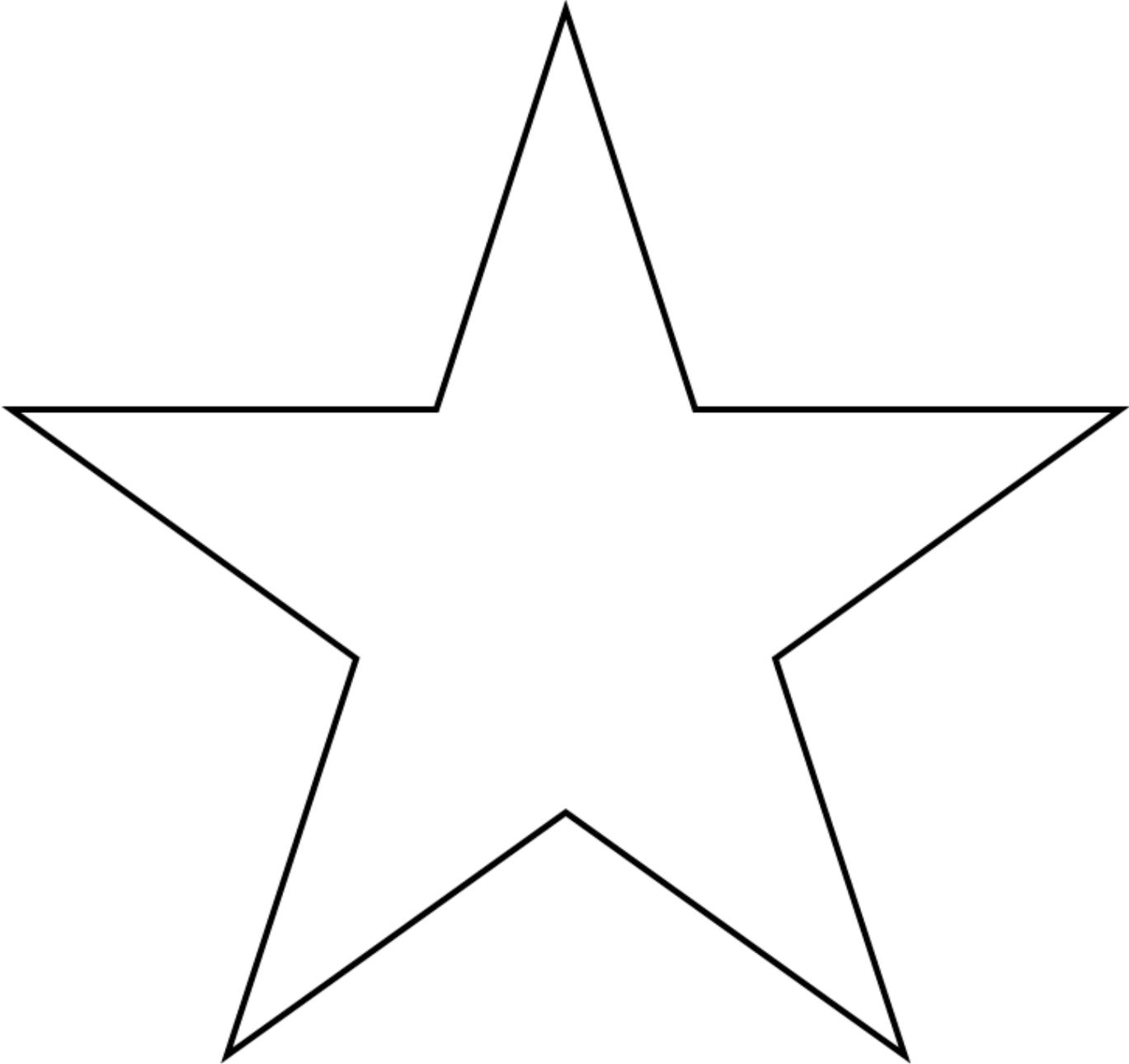
Badge Template



Badge Template



Badge Template



Break

Time: 5 minutes

Workplace Wellness

Time: 10 minutes

Materials:

- May vary depending on what activity is selected

Take a minute to complete a short physical activity. You can find several ideas for quick physical activities design for kids through an internet search.

Design a Journal

Time: 20 minutes

Materials:

- Student journals (See note in materials section.)
- Markers
- Scissors
- Construction paper
- Other craft materials

Have students create a journal to take notes, share wonderings, write reflections, and collect ideas. Ideas for types of journals can be found online.

Readings and Wonderings

Time: 20 minutes

Materials:

- Book or videos about toys, inventing toys, or toy's with wheels and axles.

Read a book, an age appropriate journal article, or watch a quick video about toys or inventing toys. Have students write things they wonder about toys in their journals.

Lunch

Time: 30 minutes

Afternoon Huddle

Time: 5 minutes

Materials: None

Now that you have your team and have some background information about toys, you have a new challenge. To be better prepared for the days ahead, you will need some basic training on the tools we will use this week. Your mission this afternoon is to:

- *Explore friction and how friction can change the way objects move*
- *Learn about wheels and axles and how they work together*

- *Investigate deeper by building a Go-Cart*

Be sure to work together, take good notes, and have fun!

Go over a few general guidelines for using the Simple Machines sets (what to do if you drop a piece on the floor, where do you put a piece you have found, what does sharing look like, etc.).

Wheels and Axles: Principle Model Lesson

Time: 45 minutes

Materials:

- Simple Machines sets
- Student worksheets ([activity pack](#) pages 50-52)
- Teacher notes for lesson ([activity pack](#) pages 41-49)
- Building instructions booklet B
- Student journals
- Plank of wood or stiff cardboard
- Stack of books

Place a wheel on either end of an axle rod. Share the model with students.

Ask students:

- What do you know about this simple machine?
- Where do we use this simple machine?
- Why do we use this simple machine?

Have students work through the Principle Model Wheels and Axles activity to investigate wheels and axles and how they work. Provide students with the correct terminology used when talking about wheels and axles gears. When they have completed the activity, students should have a better understanding of the following vocabulary:

- Force
- Fixed axle
- Separate axles

Have students write some notes on these words in their journals.

Have students write a brief reflection on the activity in their student journals.

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Wheels and Axles: Exploring Friction

Time: 25 minutes

Materials:

- Simple Machines sets
- Student worksheets ([activity pack](#) pages 50-51)
- Teacher notes for lesson ([activity pack](#) pages 41-49)
- Building Instruction booklet B
- Student journals
- Plank of wood or stiff cardboard
- Stack of books
- Various material that can be placed on plank of wood for friction testing (e.g. felt, foil, carpet squares, etc.)

Have students build Models B1 and B2 again.

Repeat Steps 1-3 (pages 50-51 of the activity guide) using different materials on the ramp for the friction test.

Ask students to create a chart in their student journals to collect data. See example below:

| | Material 1 _____ | | Material 2 _____ | | Material 3 _____ | |
|----|------------------|-----------|------------------|-----------|------------------|-----------|
| | Easy | Difficult | Easy | Difficult | Easy | Difficult |
| B1 | | | | | | |
| B2 | | | | | | |

Have students answer the following questions:

- Is each model affected by friction?
- How far did each model travel?
- How easy or difficult was it to make model B1 move compared to model B2?
- Did changing the surface affect how the model moved? Why or why not?

Break

Time: 5 minutes

Main Activity: Go Cart

Time: 50 minutes

Materials:

- Simple Machines sets
- Student journals
- Materials for creating a test track (e.g. masking tape, large paper, markers, etc.)
- Ruler
- Teacher notes ([activity pack](#) pages 53-59)
- Student worksheets ([activity pack](#) pages 60-63)

- Building instructions booklet B

Share the following with students:

Sam and Sally love going to the fair. They enjoy racing on the go-cart track. It's also fun just to drive around, waving to their friends and families, but they have to keep a careful eye on the track—not all go-carts are that easy to steer.

- *Have you tried steering a go-cart?*
- *What do you enjoy most about go-carts?*
- *Which simple machine is needed for a go-cart to move and turn?*

Let's build a go-cart!

Follow the lesson plan for the Main Activity: Go Cart, which is available at <https://education.lego.com/en-us/lessons/sm/go-cart#Planitem0> and contains the lesson plan, student worksheets, building instructions, and teacher notes.

For this lesson, you need to create a test track. You could have students use masking tape or other easy to remove tape to mark off an area of the floor. Alternately, you could provide students with large pieces of paper, such as bulletin board paper, and tape or markers to create a track.

Extension:

Challenge students to rebuild the go-cart. For example, have students explore the effects of using separate axles for the back wheels, or by using different wheels.

Ask students:

- *What do you notice?*
- *Explain how the axles are different.*

Have students record their observations in their student journals.

Take the go-carts apart and put materials away. Have students reflect in their journals:

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Daily Debrief and Wrap Up

Time: 10 minutes

Materials:

- Sticky notes
- Student journals
- Pencils
- Pens
- Markers

Have students take a quick inventory of the set for just the following materials:

- Gray and black axle rods
- Minifigs

Have students use sticky notes to write down three things they really enjoyed about the day. Have students use a different sticky note to write down one thing they are still wondering about. Place sticky notes in their student journals.

Toy Factory: Toys that Spin Day 2

Toys that Move: More Wheels and Axles

Big Question:

How do toys move?

How can wheels and axles help toys move in different ways?

Materials needed for the day:

- Simple Machines sets
- Chart paper
- Student journals
- Various craft materials
- Pens
- Pencils
- Markers
- Book, articles and/or videos about gears and toys that use wheels and axles
- Example of wobbly animal toys
- Yo-yo

| Outline for Day | Tasks | Time | Materials |
|-----------------|--|--------|---|
| 9:00 - 10:30 | Welcome | 5 min | <ul style="list-style-type: none">● Student journals |
| | Team Building Activity | 15 min | <ul style="list-style-type: none">● LEGO® bricks● Bricktionary Cards |
| | Review Group Rules Chart | 5 min | <ul style="list-style-type: none">● Group Rules Chart |
| | Morning Huddle | 5 min | <ul style="list-style-type: none">● None |
| | Readings and Wonderings | 20 min | <ul style="list-style-type: none">● Book or journal article about wheels and axles● Yo-yo● Student journals |
| | Workplace Wellness (physical activity) | 10 min | <ul style="list-style-type: none">● Varies, based on the activity selected |

| | | | |
|---------------|--|--------|---|
| | Challenge 1: Wheelbarrow | 30 min | <ul style="list-style-type: none"> • Simple Machines sets • Student journals • Student worksheets • Teacher notes |
| 10:30 - 10:35 | Break | | |
| 10:35 - 11:25 | Challenge 1: Wheelbarrow part 2 | 30 min | <ul style="list-style-type: none"> • Simple Machines sets • Student journals |
| | Afternoon Huddle | 5 min | <ul style="list-style-type: none"> • None |
| | Inventory | 10 min | <ul style="list-style-type: none"> • Simple Machines sets |
| | Challenge 2: Wobbly Animals- Introduction | 10 min | <ul style="list-style-type: none"> • Student journals |
| 11:25 | Get ready for lunch | | |
| 11:30 - 12:00 | Lunch | | |
| 12:00 - 2:10 | Challenge 2: Wobbly Animals (Design and Build) | 60 min | <ul style="list-style-type: none"> • Simple Machines sets • Student journals • Craft materials |
| | Break | 5 min | <ul style="list-style-type: none"> • None |
| | Challenge 2: Wobbly Animals (Story) | 60 min | <ul style="list-style-type: none"> • Simple Machines sets • Student journals • Craft materials |
| | Clean Up | 5 min | <ul style="list-style-type: none"> • None |
| 2:10 - 2:30 | Daily Debrief and Wrap Up | 20 min | <ul style="list-style-type: none"> • Student journals |

Welcome

Time: 5 minutes

Materials:

- Student journals

Welcome students back! Have students take a minute to read over the sticky notes placed in their journals from the previous day. Have students share their favorite moments from the previous day with a partner.

Team Building Activity

Time: 15 minutes

Materials:

- Loose LEGO® bricks and cards with objects to build

Place students in groups of 4-5 for team building activity - Bricktionary.

Bricktionary:

Have students play one round of Bricktionary. Students will draw a card from the stack without showing the word to their teammates. Then using bricks, students will build the object while teammates try to guess what it is. The game is over when everyone has had a turn.

Bricktionary Cards

| | |
|--------|-----------|
| drum | cupcake |
| spider | butterfly |
| fish | grapes |
| kite | smile |



Review Group Rules and Expectations

Time: 5 minutes

Materials:

- Group Rules Chart (from Day 1)

Quickly review the Group Rules Chart and expectations created on Day 1 by the students. Highlight positive moments from Day 1 (times when students helped each other, asking great questions, teamwork, helping to clean up, etc.).

Morning Huddle

Time: 5 minutes

Materials: None

Welcome back toy makers! Yesterday, we explored wheels, axles and friction. Who can share one thing they learned yesterday about wheels, axles and friction?

This morning, your job is to continue to investigate wheels and axles and how they are used in different ways.

What are some different ways wheels and axles are used to build things? How do you think wheels and axles are used in toys?

You will be building a model of a wheelbarrow this morning to explore how weight can affect the movement of wheels and axles.

Readings and Wonderings

Time: 20 minutes

Materials:

- Books or journal articles about wheels and axles
- Books or journal articles about toys with wheels and axles
- Student journals
- Yo-yo

Read a book or an age appropriate journal article about wheels and axles. Ask students if they think a yo-yo uses a wheel and axle or some other kind of simple machine. Have students record their claims in the journals with evidence from the reading or experiences from the day before. If students participated in the Simple Machines Intro Program on Gears and Pulleys, they will have had experience building a yo-yo.

Workplace Wellness

Time: 10 minutes

Materials:

- Varies depending on what activity is selected

Take a minute to complete a short physical activity. You can find several ideas for quick physical activities design for kids through an internet search.

Problem Solving Activity: Wheelbarrow

Time: 30 minutes

Materials:

- Simple Machines sets
- Student journals
- Student worksheets ([activity pack](#) pages 64-65)
- Teacher notes for lesson ([activity pack](#) pages 66-68)

Share the following story with students:

When Sam and Sally visit the fair, they always remark on how tidy the area is kept. However, not everybody remembers to throw their litter in the bin. Having so many people in one place at one time means that a lot of people working at the fair must spend time picking up litter. Sam and Sally want to help the people working at the fair to carry the many the bags of litter that have been gathered.

Let's help Sam and Sally!

Build a wheelbarrow like the one in the picture. Your design brief is as follows:

- *Build a wheelbarrow.*
- *Give your wheelbarrow handles, and legs to support it while standing.*
- *Your wheelbarrow must be able to carry the LEGO® weight.*

When you have finished, test the wheelbarrow. Push it along with the LEGO® weight in it. Check to see if it is well balanced.

Assess how easily the wheelbarrow can be moved in a straight direction and turned. What makes it easy or difficult to steer?

Have students work with their partners to complete the wheelbarrow design challenge. Encourage students to brainstorm and sketch different ideas for their wheelbarrow. They can record these in their student journals.

Break

Time: 5 minutes

Problem Solving Activity: Wheelbarrow Part 2

Time: 20 minutes

Materials:

- Simple Machines sets
- Student journals
- Small materials of different weight for litter

This is a continuation of the Wheelbarrow lesson.

Have students evaluate the performance of their model and its efficiency in holding different types of material.

When the model is finished, encourage students to reflect on both the product that they have produced and the processes they have used by:

- Carrying out tests to evaluate the performance of their model
- Reflecting on the design brief
- Recording their design by drawing or taking digital photos

After the lesson, have students take apart the wheelbarrow models and return pieces to the Simple Machines sets.

Have students reflect in their student journals:

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Afternoon Huddle

Time: 5 minutes

Materials: None

Now that you have investigated wheels and axles a little more through building and testing a wheelbarrow, I am presenting you with a new challenge. I would like for you to use what you have learned about the movement of different objects that use wheels and axles to design a new toy. This toy is called “wobble animals.” Your teacher will provide you with a design brief.

Before we get started on this building challenge, let’s do a quick inventory check of our Simple Machines sets.

Inventory Check

Time: 10 minutes

Materials:

- Simple Machines sets

Have students place all red items from the set on the lid of the box. Then, using the paper insert in the set (the one that is placed under the lid of the box), have students count and replace pieces back to the tray. Teams should be able to complete the inventory count of red pieces in less than ten minutes. If pieces are missing, have students search other compartments, look to see if the piece is stuck in or on another piece, or check the LEGO® lost and found area in your classroom.

Wobble Animals

Time: 10 minutes

Materials:

- Student journals

Share the following design brief with students:

Sam and Sally were playing outside when they noticed one of their neighbors taking a walk with their daughter. The little girl was pulling a toy animal behind her, that wobbled left and right as she pulled it down the sidewalk. Sam and Sally decided they want to build their own wobble animals, too! They thought it would be fun to write a story about their wobble animal to share with their friends!

Let's help Sam and Sally!

Build a wobble animal and write a short story with your wobble animal as the main character!

Your design brief is as follows:

1. *Design and build a wobble animal that:*
 - *Wobbles when it rolls (up and down or side to side)*
 - *Rolls when pulled by a string*
 - *Is a real or imagined animal*
 - *Must include LEGO® bricks or elements and additional craft materials*
2. *Write a story about your wobble animal.*

Have students follow work with their partner to brainstorm and sketch different ideas for different wobble animals.

After lunch, students will complete the build and share phase of this lesson.

Lunch

Time: 30 minutes

Wobble Animals

Time: 60 minutes

Materials:

- Simple Machines sets
- Student journals
- Optional Materials
 - Paper
 - Cardboard
 - Markers
 - String or yarn
 - Fabric
 - Tape

- Other appropriate craft materials

Provide time for students to finish designing and then building their wobble animals. Remind students to review the principle models they built previously if they need some help. You may decide to provide additional craft material for students to use within their models.

Break

Time: 5 minutes

Wobble Animals

Time: 60 minutes

Materials:

- Simple Machines sets
- Student journals
- Optional Materials
 - Paper
 - Cardboard
 - Markers
 - String or yarn
 - Fabric
 - Tape
 - Other appropriate craft materials

Have students finish wobble animals and story. Ask students to share what they have created with the class or record their story and wobble animal to share during the toy fair on Day 4.

Encourage students to reflect on both the product that they have produced and the processes they have used by:

- Testing to evaluate the performance of their model
- Reflecting on the design brief
- Recording their designs by drawing or taking digital photos

Have students reflect in their journals:

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Clean Up

Time: 5 minutes

Have students disassemble their models, throw away trash, and return the LEGO® pieces correctly to the proper trays in their Simple Machine sets.

Daily Debrief and Wrap Up

Time: 20 minutes

Materials:

- Student journals
- Markers
- Colored pencils
- Crayons

Have students write one word that they feel reflects what they have learned today. Write and illustrate the word in their student journals.

Toy Factory: Toys that Move Day 3

Toys that Move: Levers

Big Question:

How do toys move?

What is a lever?

Are there different kinds of levers?

How can levers help toys move in different ways?

Materials needed for the day:

- Simple Machines sets
- Student journals
- Various craft materials
- Pens
- Pencils
- Markers
- Book about pulleys

| Outline for Day | Tasks | Time | Materials |
|-----------------|-----------------------------------|--------|---|
| 9:00 - 10:30 | Welcome | 5 min | <ul style="list-style-type: none">• Student journals |
| | Team building activity | 15 min | <ul style="list-style-type: none">• LEGO® bricks |
| | Review Group Rules Chart | 5 min | <ul style="list-style-type: none">• Group Rules Chart |
| | Morning Huddle | 5 min | <ul style="list-style-type: none">• None |
| | Readings and Wonderings | 10 min | <ul style="list-style-type: none">• Various books or articles on levers |
| | Inventory Check | 5 min | <ul style="list-style-type: none">• Simple Machines sets |
| | Challenge 1: Investigating Levers | 45 min | <ul style="list-style-type: none">• Simple Machines sets• Student journals |

| | | | |
|---------------|---|------------|--|
| 10:30 - 10:35 | Break | | |
| 10:35 - 11:05 | Challenge 2: Catapult | 30 min | <ul style="list-style-type: none"> • Simple Machines sets • Student journals |
| 11:05 – 11:25 | Challenge 3: Toy Design Catapult Games | 20 min | <ul style="list-style-type: none"> • Simple Machines • Student journals • Various craft materials |
| 11:25 – 11:30 | Get ready for lunch | | |
| 11:30 - 12:00 | Lunch | | |
| 12:00 – 1:00 | Challenge 3: Toy Design Catapult Games | 50 min | <ul style="list-style-type: none"> • Simple Machines sets • Student journals • Craft materials |
| | Workplace Wellness (physical activity) | 10 min | <ul style="list-style-type: none"> • Varies, based on the activity selected |
| 1:00 – 1:05 | Break | | |
| 1:05 – 2:10 | Afternoon Huddle | 5 min | <ul style="list-style-type: none"> • None |
| | Challenge 4: Problem-Solving Activity: Railroad Crossing Gate | 60 minutes | <ul style="list-style-type: none"> • Simple Machines sets • Student journals |
| 2:10 - 2:30 | Daily Debrief and Wrap Up | 20 min | <ul style="list-style-type: none"> • Student journals |

Welcome

Time: 5 minutes

Materials:

- Student journals

Welcome students back! Have students take a minute to share their word they create the day before with a neighbor. Compile a list of the words as a group. You can create a word cloud to share on the last day of the program.

Team Building Activity

Time: 15 minutes

Materials:

- LEGO® bricks

Place students in pairs.

Balancing Act

Challenge students to build a LEGO® structure by stacking the flat sides of the bricks not connecting the bricks together.

Extensions:

- Build the tallest structure
- Build the tallest and widest structure
- Build a structure where part is hanging off the table.

Review Group Rules Chart

Time: 5 minutes

Materials:

- Group Rules Chart (from Day 1)

Quickly review the group rules and expectations created on Day 1 by the students. Highlight positive moments from Day 2 (times when students helped each other, asking great questions, teamwork, helping to clean up...).

Morning Huddle

Time: 5 minutes

Materials: None

Hello! This morning, your job is to investigate levers.

You will be exploring questions such as:

- *How are levers a simple machine?*
- *Where are levers used?*
- *Are there toys that use levers?*

You will build a model that can help you better understand how this simple machine works. Then, you will use your knowledge to design a game!

Readings and Wonderings

Time: 10 minutes

Materials:

- Various books or materials on levers

Read a book or an age appropriate journal article about levers, toys using levers or everyday objects that use levers.

Have students record three things they learned about levers and one thing they are still wondering.

Inventory Check

Time: 5 minutes

Materials:

- Simple Machine sets

Ask students to find their partner from Day 1.

Have students place LEGO® bricks and elements that are white on the lid of the box. Then, using the paper insert in the kit (the one that is placed under the lid of the box) have students count and replace pieces back to the compartment. Teams should be able to complete this task in five minutes. If pieces are missing, have students search other compartments, look to see if the piece is stuck in or on another piece or check the LEGO® lost and found area in your classroom.

Challenge 1: Investigating Levers

Time: 45 minutes

Materials:

- Simple Machines sets
- Student journals
- Student worksheet ([activity pack](#) pages 77-78)
- Teacher notes ([activity pack](#) pages 69-76)
- Building instructions booklet C

Complete the principle models for levers.

Introduce the principle model levers to students. Ask students to think about things they learned or questions they have about levers from the reading and wonderings earlier.

Things to talk about:

- What do you know about the simple machine - levers?
- Where do we use levers?
- Why do we use levers?

Have students work through the lever principle model lesson.

Students should understand the following vocabulary following the lesson:

- First class lever

- Second class lever
- Third class lever
- Load
- Effort
- Pivot or fulcrum

Have students write a few notes in their journals about each word.

Have students reflect in their journals:

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Break

Time: 5 minutes

Challenge 2: Catapult

Time: 30 minutes

Materials:

- Simple Machines sets
- Student journals
- Student worksheet ([activity pack](#) pages 86-87)
- Teacher notes ([activity pack](#) pages 79-85)
- Building instructions booklet C

Note: Have students work through the end of page 87.

In this activity students will build and test models that use the following structures:

- First class levers

To perform this activity, students should be familiar with the following vocabulary associated with levers:

- Pivot or fulcrum
- Load
- Effort

Share the following story with students:

Sam and Sally love going to the fair. There is a catapult game, where players shoot at a goal to win prizes by scoring most points. Sam and Sally love competing against their friends and families.

Do you like playing games where you aim at a goal?

What do you enjoy most about them?

Which simple machine is needed for a catapult to work?

Let's build a catapult!

Use the lesson plan and student worksheet to guide students through the following activities:

- Build Catapult Model C3 using building instruction booklet C
- Compare Catapult Model C3 and C4
- Predict how the models will throw items differently
- Test Catapult Model C3
- Build and test Catapult Model C4
- Draw a conclusion and test predictions

When lesson is complete, leave the models together.

Challenge 3: Catapult Game

Time: 20 minutes (will continue after lunch)

Materials:

- Simple Machines sets
- Student journals
- Student worksheet ([activity pack](#) page 88)
- Teacher notes ([activity pack](#) page 84)

Ask students to make a game with rules that they can play using the catapult.

Toy Design: Catapult Game

Ask students to make a game with rules that they can play using the catapult.

Note: There are no building instructions included, other than the illustrated suggestions on the student worksheet.

Share the design brief with students.

Design Brief

Create a game using a catapult.

Your game needs to:

- Have a name
- Include rules for playing
- Have a way to win
- Combine LEGO® bricks and elements with other materials
- Be colorful and engaging to play

Encourage your students to discuss the importance of agreeing on rules for the game before playing, prompting them with questions such as:

- What is the aim of the game?
- Describe what happens if you miss.
- How many times are you allowed to try?

- Describe how you can win the game.
- How will you make sure your rules are followed?

It is suggested that students create a sign explaining the rules and inviting people to play the game.

Have students reflect in their journals:

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Lunch

Time: 30 minutes

Challenge 3: Catapult Game (continued)

Time: 50 minutes

Materials:

- Simple Machines sets
- Student journals
- Student worksheet ([activity pack](#) page 88)
- Teacher notes ([activity pack](#) page 84)

Ask students to continue working on their game designs. Provide 15-20 minutes at the end of the session for students to play the student designed games.

When students have completed the activity, take pictures or videos of their games, and then have students disassemble them, replacing pieces to the Simple Machine sets.

Have students reflect in their journals:

- Which game(s) did the you play?
- What game(s) did you enjoy playing? Why?
- What was easy about this challenge?
- What game(s) was difficult? Why?
- What did I learn from this challenge?

Workplace Wellness

Time: 10 minutes

Materials:

- Varies depending on what activity is selected

Take a minute to complete a short physical activity. Ideas for different types of short, age appropriate physical activities can be found through a quick internet search.

Afternoon Huddle

Time: 5 minutes

Materials: None

Hello! This morning, you will put your detective skills to use and investigate levers. Your final challenge of the day will be to design and build a railroad crossing gate to explore other ways levers are used.

Challenge 4: Problem-Solving Activity Railroad Crossing Gate

Time: 60 minutes

Materials:

- Simple Machines sets
- Student journals
- Student worksheet ([activity pack](#) page 90)
- Teacher notes ([activity pack](#) pages 92-94)
- Paper
- Cardboard
- Markers

Share the following with students:

When Sam and Sally visit the fair, certain paths have railroad crossing gates. This is because you can take a train ride around the different areas of the fairground, but you have to be careful crossing the train tracks. On their way to the train ride, Sam and Sally notice that the railroad crossing gate is broken. They want to try to fix it before the train comes.

Let's help Sam and Sally!

Build a railroad crossing gate like the one in the picture.

Your design brief is as follows:

- *Build a railroad crossing gate longer than 15 cm (6 inches)*
- *Build a single stand for the gate to balance on*
- *Find a way to make it easy to open and close the gate*

When you have finished, measure the length of your railroad crossing gate, and assess how easy it is to open and close. Assess how well balanced the railroad crossing gate is. What makes it stable?

Follow the teacher notes on page 92 of the activity pack for the remainder of the lesson. When the model is finished, encourage students to reflect on both the product that they have produced and the processes they have used by:

- Carrying out tests to evaluate the performance of their model
- Reflecting on the design brief
- Recording their design by drawing or taking digital photos
- Adding notes to their student journals

When students have completed the activity have students disassemble the models, replacing pieces to the Simple Machine sets.

Have students reflect in their journals:

- What was easy about this challenge?
- What was difficult about this challenge?
- What did I learn from this challenge?

Daily Debrief and Wrap Up

Time: 20 minutes

Materials:

- LEGO® bricks
- Student journals
- Camera or something to take a picture

Have students use LEGO® bricks to build a model that represents two things they learned today. Have students take draw a sketch of the build and take some notes regarding their builds in their journals about their build. Have students take pictures of their builds. Use pictures to create a collage for display for Day 4.

Note: You can leave the models intact for the morning activity, if it suits. Place a sticky note on each model with child's name for easy retrieval. If models are taken apart, you can simply use student journal documentation.

Toy Factory: Toys that Move Day 4

Culminating Project: Toy Fair

Let's Share What We've Learned!

| Outline the Day | Tasks | Time | Materials |
|-----------------|--|--------|--|
| 9:00 - 10:30 | Welcome and Team Building Activity | 20 min | <ul style="list-style-type: none">LEGO® bricks |
| | Review Group Rules Chart | 5 min | <ul style="list-style-type: none">Group Rules Chart |
| | Morning Huddle | 5 min | <ul style="list-style-type: none">None |
| | Toy Design and Build | 60 min | <ul style="list-style-type: none">Simple Machines setsCraft materials |
| 10:30 - 10:35 | Break | | |
| 10:35 - 11:25 | Toy Design and Build | 50 min | <ul style="list-style-type: none">Simple Machines sets |
| 11:25 – 11:30 | Get ready for lunch | | |
| 11:30 - 12:00 | Lunch | | |
| 12:00 – 12:30 | Toy Build/Project Wrap Up | 30 min | |
| 12:30 – 12:35 | Showcase Overview and Expectations | 5 min | <ul style="list-style-type: none">None |
| 12:35 – 12:50 | Culminating Project: Set up for Showcase | 15 min | <ul style="list-style-type: none">Simple Machines sets |

| | | | |
|--------------|---|--------|--|
| 12:50 – 1:50 | Showcase | 60 min | <ul style="list-style-type: none"> • Student Projects |
| 1:50 - 2:30 | Daily Debrief, Clean Up and Program Wrap Up | 40 min | <ul style="list-style-type: none"> • Simple Machines sets • Certificates of Completion |

Welcome

Time: 5 minutes

Materials:

- Student journals

Welcome students back! On a piece of chart paper, draw a very large light bulb. Have students write positive things they discovered about themselves during the program.

Team Building Activity

Time: 15 minutes

Materials:

- LEGO® bricks

Create a Mascot

Have each student work in pairs to create a mascot for their team. Students should give their mascot a name and special characteristic to share with the other groups.

Review Group Rules Chart

Time: 5 minutes

Materials:

- Group Rules Chart (from Day 1)

Quickly review the group rules and expectations created on Day 1 by the students. Highlight positive moments from Day 3 (times when students helped each other, asking great questions, teamwork, helping to clean up...).

Morning Huddle

Time: 5 minutes

Materials: None

Do you know what a toy fair is? A toy fair is an exhibition where toys are shared to the public, many of them for the first time! One of the biggest toy fairs is held in New York City every year.

Today, your challenge is for your company to design a new toy. At the end of the day, you will have a chance to share your toy invention with others at our own toy fair.

Culminating Project: Toy Fair

Time: 60 minutes

Materials:

- Simple Machines sets
- Additional LEGO® bricks and elements
- A selection of children's picture books
- Craft materials
- Student journals
- Play money (optional)

Share with students the images or video clips of a toy fair. Then share the following design brief with students:

Sam and Sally live around lots of other kids their age. They like to get together and play in their neighborhood. One day, while they were playing, they noticed an advertisement for a toy fair.

Sam and Sally have a fabulous idea! What if they created a toy and encouraged their friends to do the same? At the end of the week, they could have a toy fair and invite other friends from their neighborhood to play with their new toy inventions.

Mrs. Jones, the local librarian, hears about the idea and wondered if Sam and Sally could create toys based on books. She hopes to feature the new toys in the library when the neighborhood toy fair is over.

Can you help Sam and Sally by designing a new toy based on a children's book to include in the neighborhood toy fair?

Your design brief is as follows:

- *Build a new toy based on a children's book*
- *Include wheels, axles, and/or levers with your new toy*
- *Use additional craft materials for decoration*
- *Name your toy*
- *Design and create a one page ad for your toy, which includes the price and your company logo or team badge*

When you have finished, test your design and modify as needed.

Note: If students are struggling with how to start on this project, suggest they build the model for the Go-Cart (wheels and axles) or Catapult (levers) as a starting point, then modify the design for their toy.

Optional: Provide each company with a specific amount of play money. Students can use any piece from the LEGO® Simple Machines set at no cost, but will need to purchase additional craft material. (For example, 3 inches of tape is one dollar, 6 inches of ribbon is two dollars, three pieces of construction paper is one dollar, etc.)

You could brainstorm additional ways for teams to earn money (working together, answering questions about simple machines, etc.)

When students have completed their designs, you could have them estimate the cost of their new toy based on how much money and time was invested to build the toy.

Break

Time: 5 minutes

Culminating Project: Toy Design and Build

Time: 50 minutes

Materials:

- Simple Machines sets
- Additional LEGO® bricks and elements
- A selection of children's picture books
- Craft materials
- Student journals
- Play money (optional)

Continue working on project.

Lunch

Time: 30 minutes

Culminating Project: Toy Build and Project Wrap Up

Time: 30 minutes

Materials:

- Simple Machines sets
- Additional LEGO® bricks and elements
- A selection of children's picture books
- Craft materials
- Student journals
- Play money (optional)

Have students finish their toy inventions and then practice sharing their designs with other groups of students.

Have students clean up their work areas to get ready for guests.

Showcase Overview and Expectations

Time: 5 min

Materials: None

Go over your expectations for the showcase in the afternoon so students are prepared for guests.

Today, we are going to share what you have learned and built with others. You will need to be prepared for our guests. Working with your partner, you will need to do the following:

- *Make sure your toy is complete and ready for play.*
- *Your one page design is visible for guests.*
- *Communicate to your guests any directions for playing with your toy.*
- *Be prepared to answer questions from our guests (As a group, you might brainstorm potential questions for students to answer.)*

Culminating Project: Set up for the Toy Fair

Time: 15 minutes

Materials:

- Student Toys
- Signs

Have each pair of students display their toys and signs for guests.

Showcase

Time: 60 minutes

Materials:

- Student work

Students should be set up and ready when guests arrive. Other materials you might have on display:

- Pictures of other toys created during the week
- Background music
- Wonderings from the week
- Student journals
- Group Rules Chart

Daily Debrief, Clean Up and Wrap Up

Time: 40 minutes

Materials:

- Student projects

- Simple Machines sets
- Student journals
- Certificates of Completion

Have students disassemble their simple machine models. Have students take time to sort and inventory the Simple Machine sets to make sure it is ready for use.

Have students clean up materials from the showcase.

Students can take home their journals.
You can present each student with a Certificate of Completion.