Moving to the Victory Line Program

A LEGO® Education Program

Intermediate BricQ Motion Prime

Moving to the Victory Line Program

LEGO® Education BricQ Motion Prime Introductory Program

4 days
6 hours per day

Program Overview:

This 4-day program outline will provide students with a STEAM-focused hands-on activities to promote 21st century skills, social and emotional learning, as well as review math, language arts and science. Each day, students will participate in team building activities and opportunities for physical activity as well as receive a daily team briefing for daily challenges aligned to standards. Daily challenges will help students develop skills and knowledge to complete the culminating project of creating a game that uses balls and force and motion.

	Essential Questions	Daily Activities
Day 1	**Welcome to Orientation** What angles, size, and shape of sails making a winning land yacht?	Creating sails Measuring Distance Modifying a Land Yacht
Day 2	What does the angle of a slope affect the distance traveled?	Ski Slope
Day 3	How do Newton's Laws of Motion apply to a human powered car?	Gymnast
Day 4	Create Your Olympic Event	Olympic Event Present your event to the class

Prior to First Day of the Program:

1. Sort the BricQ Motion Prime sets. (If the sets were used the prior week for camp and the facilitator checked the sets as a part of releasing students, this should not take long.)
2. Go through the Getting Started guide. https://education.lego.com/en-us/start/bricq-motion-prime#Introduction
3. Determine a naming convention for each set and label. Suggestion to include school initials and a number (Example: Millcreek Elementary BricQ Motion Prime kits names could be MEBQ1; MEBQ2; MEBQ3)and write name on the lid and inventory sheet. (This should have been accomplished before the introductory week.)
4. Print one copy of the student worksheet for each team of 2 students. https://education.lego.com/v3/assets/blt293eea581807678a/blt39f06cbd7b2f1a3f/5eabfbf1b8a6356e4ddc0ce7/U3L4-worksheet.pdf
5. Gather a rulers, tape measure, and scissors for each group.
6. Gather any consumable materials needed for the week (chart paper, sticky notes markers, pens, pencils, tape).
7. Determine a procedure for when a LEGO® element is dropped (everyone freeze; say LEGO down/LEGO found) and where to place the LEGO element if found and does not belong to the finder.
8. **Note:** If students are not receiving a Personal Learning Kit to use for the culminating activity on the last day, then the Inventory Check should be placed at the end of the final day.

Moving to the Victory Line Program Day 1

Welcome to Orientation

Big Question:

- How does a sail cause a sail car or sail boat to move?

Materials needed for the day:

- BricQ Motion Prime sets
- Chart paper
- Student journals or journals (could be paper stapled together with students creating the outside of the journal using construction paper and other consumable materials)
- Pens
- Pencils
- Markers
- Sticky notes
- Graph paper
- Tape
- Scissors
- Tag board (for making sails)
- Lightweight cardboard (for making sails)
- Construction paper
- Plastic wrap, wax paper, plastic sheets (for making sails)
- Rulers and tape measures
- Large fans

Day 1: Outline for the Day

Outline of Day	Tasks	Time	Materials
9:00 - 10:20	Introductions	20 min	• BricQ Motion Prime Set
	Establishing group rules and expectations	15 min	• Chart paper • Markers • Pens
	Team Building Activity	15 min	• BricQ Motion Prime Set
	Team Briefing 1	5 min	• None

	Partner selection, team name and team badge	15 min	• Varies, based on the activity selected • Team badge templates • Markers • Pencils • Scissors
10:20 - 10:25	Break		
10:25 - 11:35	Workplace Wellness (physical activity)	10 min	Varies, based on the activity selected
	Design a journal for record keeping	15 min	Student journals (see note in materials section) Markers Scissors Construction Paper Other craft materials
	Reading and wondering about simple machines	30 min	Book about simple machines Student journals
	Team Briefing 2	15 minutes	None
11:35	Get ready for lunch		
11:40 - 12:10	Lunch		
12:10 - 2:10	Challenge 1: Land Yacht Experiment 1	40 min	• Student journals • BricQ Motion Prime sets • Student worksheets • Graph paper • Building Instruction Booklet
	Challenge 1: Land Yacht Experiment 2	40 min	• Student journals • BricQ Motion Prime sets • Student worksheets • Graph paper • Building Instruction Booklet
	Break	5 min	• None

	Challenge 1: Land Yacht Experiment 3	40 min	• BricQ Motion Prime sets • Student worksheets • Graph paper • Building Instruction Booklet • Student journals
2:10 - 2:30	Daily debrief and wrap up	20 minutes	• Student journals

Introductions
Time: 20 minutes
Materials:
- BricQ Motion Prime Set

Purpose: For students to get to know each other

Show a video of sail boats and sail cars. Ask students if any of them have watched races of sail boats or sail cars. What forces act upon the sail? How can a sail be used to move in a direction other than with the wind? Ignite a discussion about sail-powered vehicles. Then, ask students to think about one thing they would like to learn about sail power.

Using the bricks, have students build a model that represents how much they would be interested in driving a sail car or piloting a sail boat. Have students share their models and their ideas.

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. Ask students to think about how they would like to be treated and the role of a partner. Consider the role of feedback and how it can help to improve ideas. Have two people work together when building with LEGO® elements so they each have the opportunity to find pieces and to put pieces together.

Team Building Activity
Time: 15 minutes
Materials:
- BricQ Motion Prime Set
- Unopened water bottles

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

Build a Strong Tower

Have students work in pairs. Challenge students to build a strong tower that can hold a water bottle.

- 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?

Have a short discussion on how individuals work together as a team. Ask students what works well and what does not.

Be sure all teams put the materials back into the BricQ Motion Prime Set properly.

Team Briefing 1:
Time: 5 minutes
Materials: None

Say this:

Welcome to orientation! Your first tasks for today are as follows:

- *Determine a partner for training exercises*
- *Work with partner to determine a name for your design company and a logo*
- *Design a journal for keeping important records this week*
- *Explore different ways we use force and motion*

Partner Selection, Olympic Team Name and Logo
Time: 15 minutes
Materials:

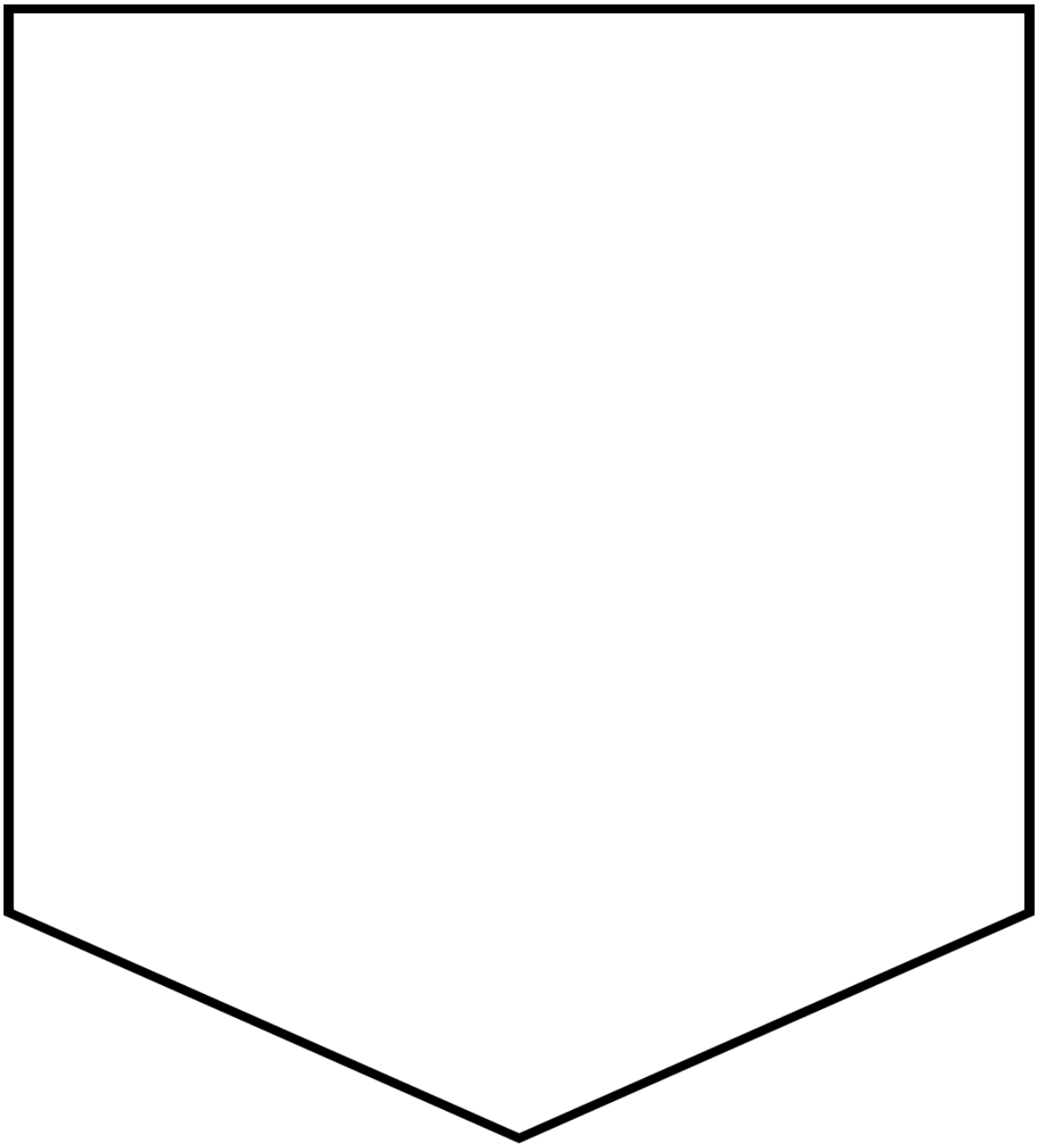
- Student journals (see note in materials section)
- Markers
- Scissors
- Construction paper
- Other craft materials

You can use several different activities to help students find a partner to work with for the week.

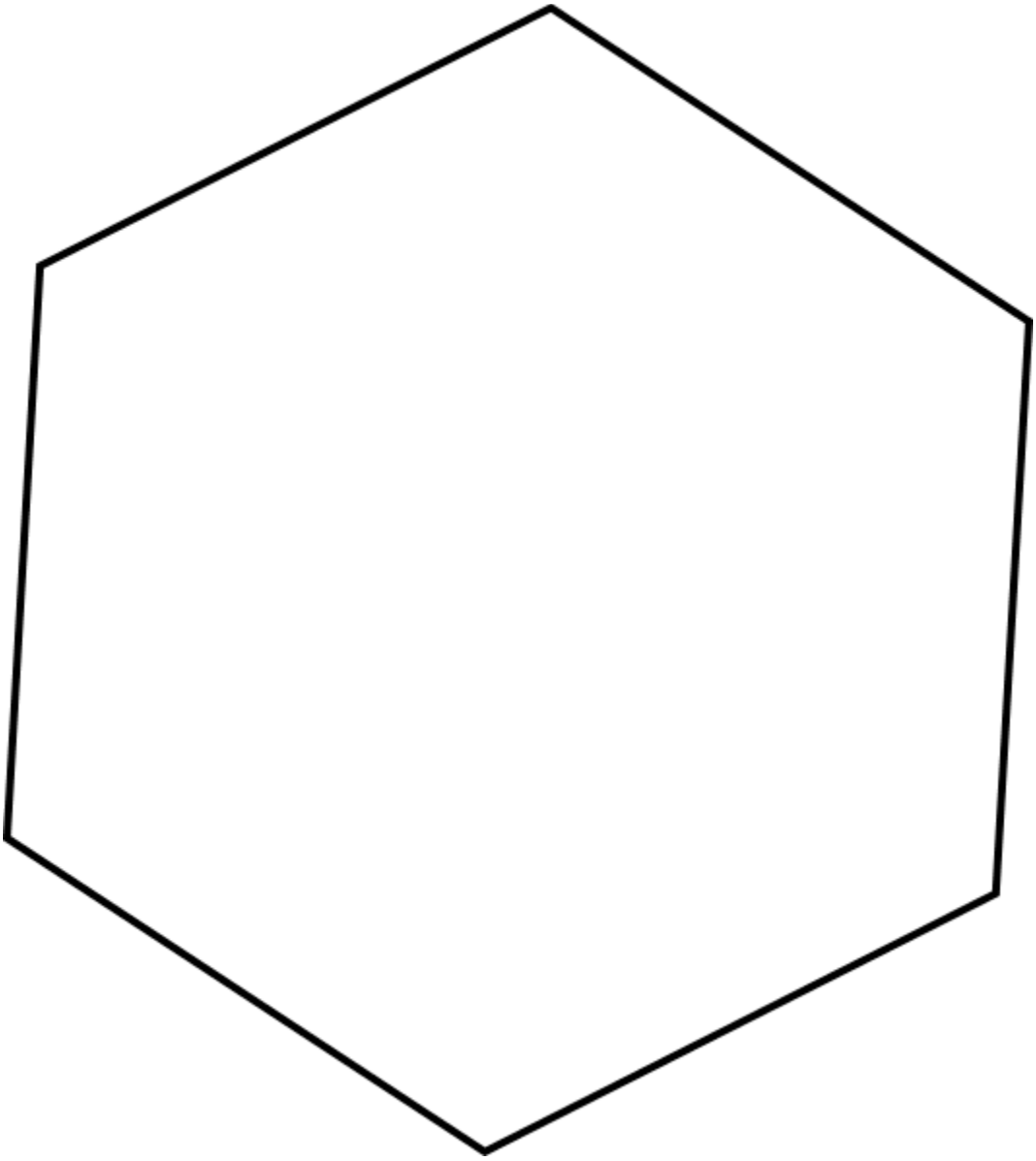
Once partners have been established, student teams can determine an Olympic team name and design a logo for their partnership.

Assign each group a BricQ Motion Prime set to use for the week – preferable a set that at least one of the partners used for the tower activity.

Logo Templates



Logo Template



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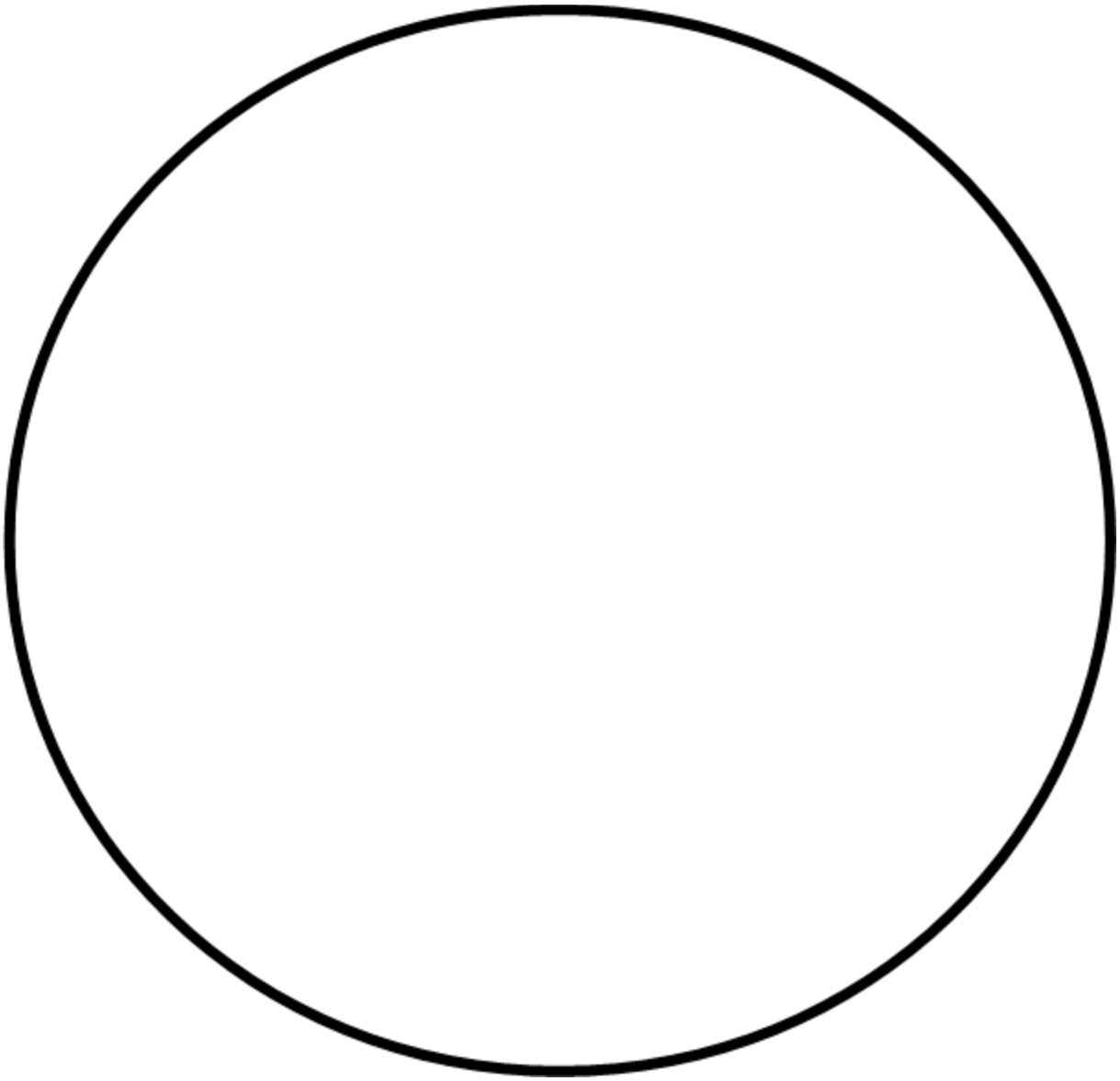
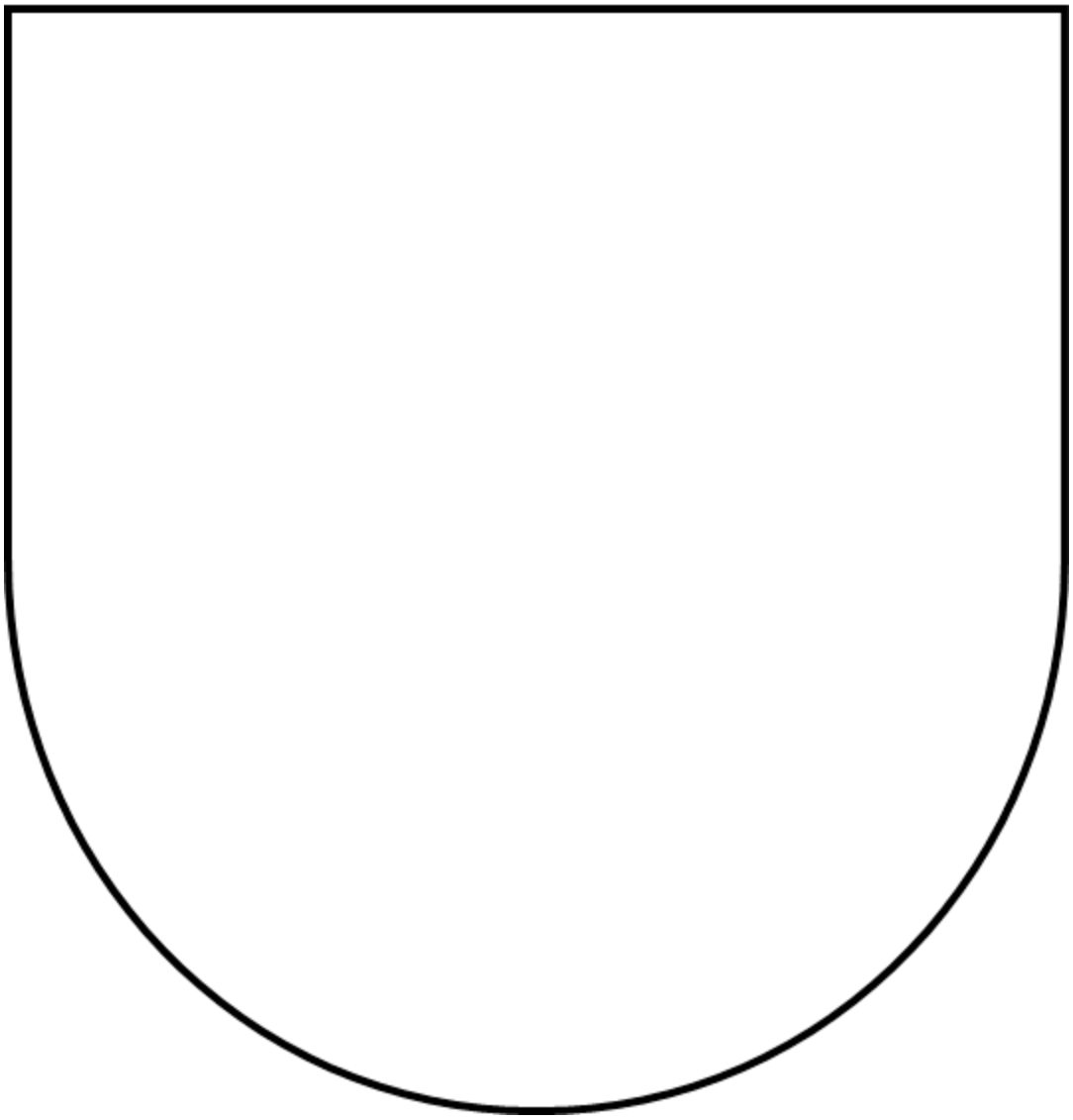
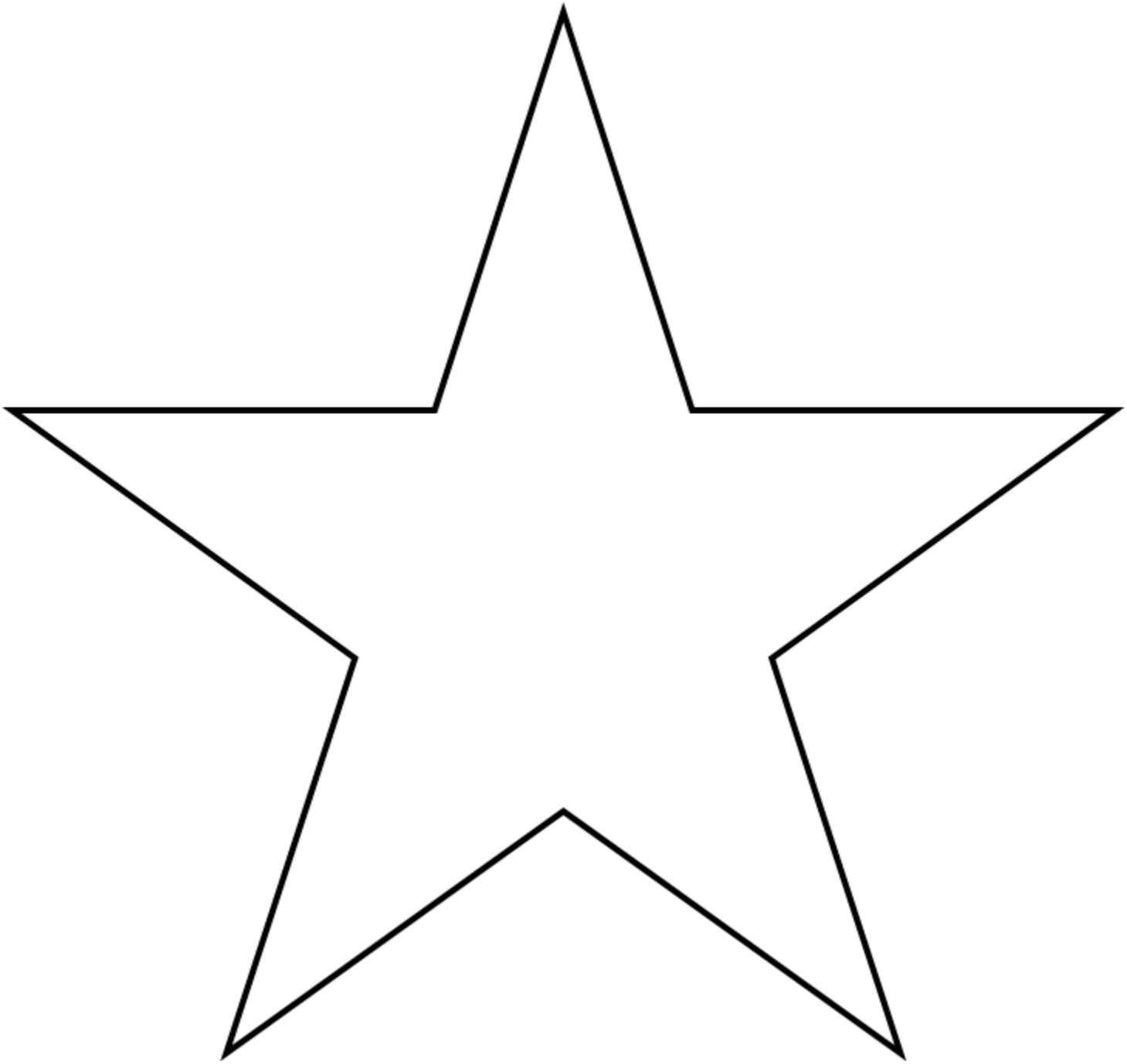


Logo Template



Logo Template



Break
Time: 5 minutes

Workplace Wellness: Physical Fitness
Time: 10 minutes
Materials:

- May vary depending on what activity is selected

Take a minute to complete a short physical activity. You may find several ideas for short physical activities for students through a simple web search. Ideas could include simple exercises like jumping jacks or running in place. Many companies encourage physical activity during the workday.

Design a Journal
Time: 15 minutes
Materials:

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

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

Readings and Wonderings
Time: 30 minutes
Materials:

- Book or articles about sail boats and sail cars

Read a book or a kid friendly journal article about sail cars and sail boats. Have students research how sail boats tack using the wind, size and shapes of sails, and what competitive events exist around sail boats and sail cars. Ask students to take organized notes in their journals from the information they found. Have students write things they wonder about sail boats and sail cars in their journals.

Discuss the students findings. Ask students to share any new vocabulary they learned and interesting facts the found during their research.

Team Briefing 2
Time: 15 minutes
Materials: None
Say this:

> *Now that you have your team and have some background information about sail boats and sail cars you have a challenge. At the end of the week you will be creating an Olympic event, so as you explore physical science topics this week, be thinking about how you can apply what you*

learn to an event. Today you are going to work with land yachts. Be sure to work together, take good notes, and have fun!

Go over a few general guidelines for using the BricQ Motion Prime sets (what to do if you drop a piece on the floor, where do you put a piece you have found, what sharing looks like, etc.).

Show the Student Video of Sail vehicles found in the lesson plan for Land Yacht. https://education.lego.com/en-us/lessons/bricq-motion-prime/land-yacht#prepare

Ask the students:

- What did you observe? What can you infer from your observations?
- Which forces did you see in action when watching the sailboat and kite in the video? (pull/push)
- Which force made the sailboat move? (It was the push force of the wind.)
- In what situations does a sailboat not work? (If the wind is blowing straight toward the sailboat; the boat can't sail directly forward into the wind.)

Tell students that they will be building a land yacht and investigating how wind force can change the vehicle's motion.

Lunch
Time: 30 minutes

Challenge 1 – Land Yacht

Time: 90 minutes
Materials:

- BricQ Motion Prime sets
- Student Engineering Design Journals
- 1 Student worksheet per team
- Graph paper
- Large fans
- Rulers
- Measuring tapes
- Tag board, cardboard, plastic wrap or wax paper for making sails

Ask the students to work in pairs to build the Land Yacht model. Tell them to take turns, one partner searching for the bricks while the other builds, switching roles after each step has been done.
Set up the fans and a starting line in front of each one. Ask students to create a table to record observations and the distance of each trial.

Experiment 1

Ask the teams to set their land yachts on the starting line, facing away from the fans. Each partner will take 5 turns running their land yacht.

Tell students to turn on the fans to **low speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner should take 5 turns running their land yacht. Have students compute the average distance traveled for the 5 trials at low speed and record in their journals.

Have students predict what will change when the fan speed is increased to medium. Tell students to turn on the fans to **medium speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner will take 5 turns running their land yacht. Have students compute the average distance traveled for the 5 trials at medium speed and record in their journals.

Have students predict what will change when the fan speed is increased to high. Tell students to turn on the fans to **high speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner will take 5 turns running their land yacht. Have students compute the average distance traveled for the 5 trials at high speed and record in their journals.

Ask teams to create a graph (bar or line) that shows the average distance at each speed for each partner.

Ask students to record the following in their journals.

- Compare the two graphs.
- Determine if there are differences between the two.
- Explain the conclusions they can draw from the data.

Lead a class discussion on the conclusions.

Experiment 2

Challenge the students to find the best sail shape for making the land yacht travel the farthest distance. They can create their own sails from the materials available. Be sure they are using the rulers to measure.

Tell students they are going to make their own sails today. Ask them what they observed about sails from the videos, research, and their own sail car. Have students measure the previous sail. Have students calculate the area of the sail in square inches or square centimeters or both.

Tell students to use the information they have learned to create their own sails. They can use any of the materials available and they will need to measure their final sail design and calculate its area.

Ask the teams to set their land yachts on the starting line, facing away from the fans. Each partner will take 5 turns running their land yacht.

Ask students to predict how much farther the land yacht will travel with their newly designed sail. Have them write the prediction in their journals.

Tell students to turn on the fans to **low speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner should take 5 turns running their land yacht. Have students compute the average distance traveled for the 5 trials at low speed and record in their journals.

Have students predict what will change when the fan speed is increased to medium. Tell students to turn on the fans to **medium speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner will take 5 turns running their land yacht. Have students compute the average distance traveled for the 5 trials at medium speed and record in their journals.

Have students predict what will change when the fan speed is increased to high. Tell students to turn on the fans to **high speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner will take 5 turns running their land yacht. Have students compute the average distance traveled for the 5 trials at high speed and record in their journals.

Ask teams to create a graph (bar or line) that shows the average distance at each speed for each partner.

Ask students to record the following in their journals.

- What materials did you try when making your sail?
- Describe your observations about different materials for making a sail.

- Compare the two graphs showing distance traveled for the land yacht with your designed sail.
- Determine if there are differences between the two and explain why they are similar or different.
- Explain the conclusions they can draw from the data.
- Compare the graphs that show data from trials using the sail from the set with the graphs that show data from trials using the designed sail.

Ask students what conclusions can be made. Discuss as a class.

Ask students:

- How did the area of the sail affect the distance traveled?
- Is a larger sail more effective?
- Can a sail be too large? Why or why not?
- What qualities of a sail are helpful?
- What qualities of a sail become issues?

Break
5 minutes

Experiment 3

Allow students to use either the sail they designed or the sail from the set for this experiment. Have students adjust the angle of the sail by turning the small gear. The red bushings can also be moved to change the shape of the sail. Have students create a table in their journals for 3 trials at each of the following angles: 45°, 90°, 135°, 180°, 225°, 270°, and 315°

Have students change the angle to 45°. Tell students to turn on the fans to **high speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner will take 3 turns running their land yacht. Have students compute the average distance traveled for the 3 trials at high speed and record in their journals.

Have students repeat the experiment at 90°, 135°, 180°, 225°, 270°, and 315° Tell students to turn on the fans to **high speed** and to let their land yachts blow downwind *(straight away from the fans)* and to make observations about their movement. Measure the distance for each trial. Record the observations and the distance traveled in your journal. Each partner will take 3 turns running their land yacht. Have students compute the average distance traveled for the 3 trials at high speed and record in their journals.

Ask teams to create a graph (bar or line) that shows the average distance at each angle. Ask students what conclusions can be made. Discuss as a class.

Ask students to take apart the Land Yacht model. Then, working with their partner, students will work to conduct an inventory check of the pieces in their kit to ensure all pieces are in the correct spots and no pieces are missing.

Students should conduct an inventory of two sections that contain pieces used to build the Land Yacht model. Students will not need to count pieces from all sections and it is quick check of their materials.

> **Note:** For a full inventory: Have students place items from one compartment 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 into the compartment. Teams should be able to complete two compartments 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.

Daily Debrief and Wrap Up
Time: 20 minutes
Materials:

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

Label three pieces of chart paper with “Enjoyed” or “Surprised by” or “Like to Do” so students can place their responses together.

Have students use sticky notes to write:

- One thing they enjoyed
- One thing they were surprised by
- One thing they would still like to do

Place sticky notes in charts labeled.

Go through some of the responses on each chart.

Moving to the Victory Line Program Day 2
Ski Slope

Big Question:
What forces affect the way a skier on a ski slope goes downhill?

Materials needed for the day:

- BricQ Motion Prime sets
- Chart paper
- Student journals
- Student worksheets https://education.lego.com/v3/assets/blt293eea581807678a/blt1cc3cdb1542f1528/5eabfbf2d046ad605a634686/U3L3-worksheet.pdf
- Measuring tapes
- Stopwatches
- Various craft materials
- Pens
- Pencils
- Markers

Day 2: Outline for the Day

Outline of Day	Tasks	Time	Materials
9:00 - 9:55	Welcome	5 min	• Student journals
	Team building activity	15 min	• BricQ Motion Prime Set Bricktionary Cards
	Review group rules and expectations and activities from yesterday.	5 min	• Group Rules Chart
	Team Briefing 1	5 min	• None
	Readings and Wonderings	25 min	• Book or journal article about gears used in machines
9:55 - 10:40	Challenge 1: Ski Slope Experiment 1	45 min	• BricQ Motion Prime sets • Building Instruction Booklet • Student journals • Measuring tapes • Stop watches

10:40 - 10:45	Break		
10:45 – 11:45	Workplace Wellness (physical activity)	15 min	• Varies, based on the activity selected
	Team Briefing 2	5 min	• None
	Challenge 2: Ski Slope Experiment 2	40 min	• BricQ Motion Prime sets • Building Instruction Booklet • Student journals • Measuring Tapes
11:45 - 11:50	Get ready for lunch		
11:50 - 12:20	Lunch		
12:20 - 1:05	Team Briefing 3	5 min	• None
	Challenge 3: Calculating Momentum	30 min	• BricQ Motion Prime sets • Building Instruction Booklet • Student journals
	Break	10 min	
1:05 - 2:10	Team Briefing 4	5 min	
	Challenge 4: Adjusting Angles on the Ski Slope Experiment 3	55 min	• BricQ Motion Prime sets • Building Instruction Booklet • Student journals
2:10 - 2:30	Clean up Daily debrief and wrap up	20 min	• Student journals

Welcome
Time: 5 minutes
Materials:

- Student journals

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

Team Building Activity
Time: 15 minutes
Materials:

- BricQ Motion Prime Set
- 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. Below are some example cards you can use for the game.

Bricktionary Cards

Van	Place
Tower	Phone
Dog	Plant
Plane	Store

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 1 (times when students helped each other, asking great questions, teamwork, helping to clean up…)

Team Briefing 1
Time: 5 minutes
Materials: BricQ Motion Prime set

Say to students:

> *Welcome back to Moving to the Victory Line! Your task today is to work with skiers going down a ski slope. You will work with angles of slope and distance traveled. What types of forces affect the skier's motion? Does mass matter? Which of Newton's Laws of Motion apply to this activity?*

Readings and Wonderings
Time: 25 minutes
Materials:

- Internet research
- Student journals
- Building Instruction Booklet
- BricQ Motion Prime Set – look at gears available

Ask students to research:

- How gravity affects objects moving downhill.
- How mass affects movement going downhill
- If the movement of the Earth affects the movement of the skier
- How angle of the slope affects movement

Discuss their findings. This information will help make predictions about the movement of their skiers.

Challenge 1: Ski Slope Experiment 1
Time: 45 minutes
Materials:

- BricQ Motion Prime sets
- Building Instruction Booklet
- Student Design Journals
- Student worksheets
- Measuring tapes
- Stop watches

Ask students to work with their partner to build the Ski Slope model. Make sure they take turns finding pieces and building.

Each team should have a flat surface that is at least a meter in length. Have students place their model at one end and place the metric measuring tape so that it starts at the end of the slope, but is not in the way of the skier. Additionally, each team needs a worksheet. Have each student create a table in their journals to show the distance traveled by each skier for 5 trials and the time it takes. An example is shown below. It is important that they use centimeters.

Skier 1	Distance Traveled (cm)	Travel Time (seconds)
Trial 1		
Trial 2		
Trial 3		
Trial 4		
Trial 5		

Skier 2	Distance Traveled (cm)	Travel Time (seconds)
Trial 1		
Trial 2		
Trial 3		
Trial 4		
Trial 5		

Demonstrate for the teams how to make a fair test. Students do not push the skier, they just hold the skier so the back of the skier touches the blue beam in back. Then, release the skier. Be sure they understand how to make all their trials the same and why it is important to hold this aspect constant. Then, ask students to time the trial and repeat. See how close the times are and repeat a few times until the students are doing a good job of timing the run. You might suggest the partner who lets the skier start says “Go” and says “Stop” when the ski comes to a halt.

Ask students to set the angle of the ski slope to 20 degrees. Ask each team to predict the distance each skier will travel after it leaves the slope. Have them write their predictions in their journals and why they think one will go farther than the other.

Each partner will slide the standing skier on a yellow ski 5 times. Students should write the distance traveled for each trial in their journals.

Have each partner slide the skier sitting on the weight brick on the blue ski 5 times. Students should write the distance traveled for each trial in their journals.

Ask students to:

- Calculate the average distance each skier traveled.
- Compare the distances of the two skiers.

- Write in their journals about their observations, data gathered and analyzed, and conclusions they can draw.
- Explain why the heavier skier traveled farther.
- Predict what would happen if the ski was removed from the heavier skier.

If students ask about the seconds, tell them that information will be used later.

Ask all teams to remove the ski from the heavier skier. Each partner should slide the second skier with out a ski down the slope. Ask students to explain their findings. (It will go a shorter distance. The curved skis [compared to a sharp rectangular corner] affect the distance that the skier travels because they reduce friction as the skier slides off the bottom of the slope.)

Workplace Wellness: Physical Fitness
Time: 10 minutes
Materials:
- May vary depending on what activity is selected

Take time to complete a short physical activity. You may find several ideas for short physical activities for students through a simple web search. Ideas could include simple exercises like jumping jacks or running in place. Many companies encourage physical activity during the workday.

Team Briefing 2
5 minutes
Say to students:

> *You have learned a lot about slopes and momentum and friction. But, there is more to do! You will be changing the angle of descent or slope and run some additional trials. That means you will be changing a variable. You should only change one variable at a time and hold everything else constant in order to make a fair trial.*

Challenge 2: Ski Slope Experiment 2
Time: 40 minutes
Materials:
- BricQ Motion Prime sets
- Student journals
- Student worksheets
- Measuring tapes

Ask students to put the ski back on the second skier. Ask students to set the angle of the ski slope to 30 degrees. Ask each team to predict the distance each skier will travel after it leaves the slope. Have them write their predictions in their journals and why they think one will go farther than the other.

Each partner will slide the standing skier on a yellow ski 5 times. Students should write the distance traveled for each trial in their journals.

Have each partner slide the skier sitting on the weight brick on the blue ski 5 times. Students should write the distance traveled for each trial in their journals.

Ask students to:

- Calculate the average distance each skier traveled.
- Compare the distances of the two skiers.
- Write in their journals about their observations, data gathered and analyzed, and conclusions they can draw.
- Explain the conclusions drawn about distance traveled and angle of the slope.

Lunch
Time: 30 minutes

Team Briefing 3
5 minutes
Tell students:

> *You have quite a bit of data, so you should use some of it to calculate and compare the momentum of each skier. You will need some additional information, like the formula and the mass. Velocity is similar to speed, but they are different. Speed is the rate at which an object covers a certain distance – a scalar value. Velocity is the rate and the direction of movement and is a vector. The symbol for Velocity is V and the symbol for Mass is M. So you might be confused when you see the symbol for Momentum is P. Well, the word impetus was used for momentum, and that came from a Latin root, petere, which is how we get the P. Don't worry – you will work together on the formula.*

Challenge 3: Calculating Momentum
Time: 30 minutes
Materials:

- BricQ Motion Prime sets
- Student journals

Tell students to write the following formula in their journals: p = m x v

Ask students to tell you what the formula represents based on what they learned in the briefing.
p (Momentum) = m (Mass) times v (Velocity)

Ask students what information they have already. Ask them if they know the mass? No – so you will need to provide it. Standing skier – 5 grams; Heavy skier – 62 grams. Tell students to write the mass of each skier in their journals.

Tell students velocity is measured in meters per second. Ask students if they know the velocity? No, they will have look at the information they have and make some calculations.
Tell students:

- The skiers did not travel a meter or more.

- They will have to convert their information.
- A meter is 100 cm. 38 cm is equal to .38 meters.

Ask students to change the average distance traveled at an angle of 20 degrees to a decimal part of a meter. Tell students both partners need to agree on the decimal number.

Have students calculate the average number of seconds it took to move the distance.

Tell students that they should now have the information they need to compute momentum.
p = mass x velocity.

Ask students to calculate the momentum for each skier using the average distance traveled and the average number of seconds.

Break
Time: 10 minutes

Team Briefing 4
Time: 5 minutes
Materials: None
Tell students:

> *You have used two angles for your skiers. What would happen if the ski slope was at 90 degrees? It would fall straight down. What would be the best angle for a ski slope if you wanted to go the farthest? Remember the only variable you can change would be the angle. You must keep the length of the slope the same or your testing will not be comparable. That means you will be changing one variable - angle. You should only change one variable (angle) at a time and hold everything else constant in order to make a fair trial.*

Challenge 4: Adjusting Angles on the Ski Slope
Time: 55 min
Materials:

- BricQ Motion Prime sets
- Student journals
- Measuring tapes

Ask students to set the angle of the ski slope to various degrees. Students may have to change the model in order to increase the angle of the slope. They should not change the length of the ski slope. Ask each team to predict the distance each skier will travel after it leaves the slope. Have them write their predictions in their journals.

Each partner will slide each skier 5 times. Students should write the distance traveled for each trial in their journals.

Ask students:

- What conclusions can you draw regarding the angle of the slope and the distance traveled?
- To explain their rationale.

When the models are completed, have students move around the room to see the other team's models. Have half the teams share their models and then switch. All students should take notes in their journals about the models they observed and how they moved.

Cleanup, Daily Debrief and Wrap Up
Time: 20 minutes
Materials:

- Student journals
- Markers
- Colored pencils
- Crayons

Have students take apart the models and put the pieces back into the correct locations in the bin trays.

Ask students to write in their journals three things that they learned today and how they learned them. You may wish to have a short discussion before asking students to write in their journals. Ask two teams to partner and share what they learned.

Moving to the Victory Line Program Day 3

Gymnast

Big Question:
How do Newton's Laws of Motion apply to a gymnast?

Materials needed for the day:

- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals
- Graph paper
- Measuring tapes
- Tape
- Chart paper
- Pens
- Pencils
- Markers

Day 3: Outline for the Day

Outline of Day	Tasks	Time	Materials
9:00 - 10:50	Welcome	10 min	• Student journals
	Team building activity	15 min	• BricQ Motion Prime Set
	Review Group Rules Chart	5 min	• Group Rules Chart
	Team Briefing 1	5 min	• None
	Readings and Wonderings	20 min	• Internet research • Student journals
	Inventory Check	5 min	• BricQ Motion Prime sets
	Challenge 1: Gymnast Experiment 1	50 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals • Tape

10:50 - 10:55	Break		
10:55 - 11:00	Team Briefing 2	5 min	• None
11:00 - 11:55	Challenge 2: Gymnast Experiment 2	55 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals • Graph paper • Tape • Measuring tape
11:55 - 12:00	Get ready for lunch		
12:00 - 12:30	Lunch		
12:30 - 1:05	Workplace Wellness (physical activity)	10 min	• Varies, based on the activity selected
	Team Briefing 3	5 min	• None
	Challenge 3: Gymnast Experiment 3	20 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals
1:05 - 1:10	Break	5 min	
1:10 - 2:10	Challenge 4: Gymnast Experiment 4	30 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals
	Team Briefing 5	5 min	• None
	Challenge 5: Gymnast Plotting Angle and Distance and Calculating Force	25 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals • Graph paper
2:10 - 2:30	Cleanup Daily debrief and wrap up	20 min	• Student journals

Welcome
Time: 10 minutes

Materials:

- Student journals

Welcome students back. Have students take a minute to share something they read yesterday about things that others learned. No need to tell who wrote the learning experience.

Team Building Activity
Time: 15 minutes
Materials:

- BricQ Motion Prime Set

Place students in pairs.

Back-to-Back
Ask students to choose the following pieces from the set:

- 4 red 2x4 bricks
- 2 red 1x8 technic bricks
- 2 yellow 2x4 bricks
- 2 yellow 1x6 technic bricks
- 2 purple angle bricks with two studs
- 4 black 2x4 plates
- 2 black 2x6 plates

Have students divide the pieces equally, so each partner has the same 9 pieces. Sit back-to-back.

Tell students to follow these directions:

> Partner 1 builds a model using 7-9 pieces without Partner 2 seeing the model. Partner 1 describes how to build the model to Partner 2 without showing the model. Partner 2 follows the instructions. Partner 2 cannot ask questions. Partner 2 can only say “repeat”. When the model is completed, Partner 2 can say “done.” Compare the two models. Are they the same?
>
> Repeat the activity with Partner 2 building and giving directions to Partner 1.

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…)

Team Briefing 1
Time: 5 minutes
Materials: None

Hello! Today you are going to think like a gymnast. What forces are used to make a gymnast move? Do Newton's Laws of Motion have relevance to a gymnast? Watch this video while you think about these questions.

Show the video from the Engage section of the Gymnast lesson plan. https://education.lego.com/en-us/lessons/bricq-motion-prime/gymnast#prepare

Research and Wonderings
Time: 20 minutes
Materials: None

Discussion and conduct Internet research on gymnastics – especially with regard to the forces used by a gymnast on a bar. When does the gymnast have potential energy and when is the gymnast using kinetic energy? How does the position of the legs affect movement? How do Newton's Laws of Motion have relevance?

Inventory Check
Time: 5 minutes
Materials:
- BricQ Motion Prime sets

Ask students to find their partner from Day 1.

Have students check to see all items in the bin are in the proper trays. Ask students to inventory the green and purple compartments.

Challenge 1: Gymnast Experiment 1
Time: 50 minutes
Materials:
- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals

Have students build the Gymnast model. Tell the to take turns finding pieces and building.

Experiment 1
Have students use a strip of tape to mark a start line. Tell them to place the model so the gymnast is hanging directly over the tape. Students should make sure the ratchet levers are folded in. Then, ask students to pull the gymnast to about a 90-degree angle and observe what happens. Each partner should have two trials.

Students should write in their journals what happens.

Discuss as a class what forces are acting upon the model. Ask students to identify the forces that are stopping the movement of the model.

Ask students:

- Why did the car move back and forth with both ratchet levers folded in? *(*It oscillates backward and forward because the net force is zero.)
- Which forces are at work? (The force of gravity pulls the gymnast down. The momentum of the swing is rigidly attached to the pivot at the top, and there's low friction on the wheels/axles, so the car moves a little bit forward and back as the gymnast swings. The forward motion is more or less equal to the backward motion, so the car doesn't actually go anywhere.)
- What pattern did you observe in the movement of the car? (The car slows down in between each swing of the gymnast.)

Break
Time: 5 minutes

Team Brief 2
5 minutes
Tell students:

You are going to change the model and explore what happens. You will write your findings in your journals using clear descriptions.

Challenge 2: Gymnast Experiment 2
Time: 60 minutes
Materials:

- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals
- Graph paper
- Measuring tapes

Ask students to place the measuring tape so that it starts at the tape and is positioned so readings of distance can be made. Have students gather some small LEGO elements to place where the car hesitates and then stops.

Students should create a table in their journal with at least 11 columns. An example is shown below:

Partner 1	Hesitate 1	Hesitate 2	Hesitate 3	Hesitate 4	Hesitate 5	Hesitate 6	Hesitate 7	Hesitate 8	Hesitate 9	Stop
Trial 1										
Trial 2										
Trial 3										
Trial 4										
Trial 5										

Have students flip the front ratchet on the car. (The back ratchet should still be folded in.)Tell them to place the model so the gymnast is hanging directly over the tape. Then, ask students to pull the gymnast to about a 90-degree angle and observe what happens. Each partner should have five trials.

Students should place a LEGO® element where the model hesitates and then where it stops. Then, they should write the locations in their journals.

> **Note:** Students should be using only the 90-degree angle. The surface the gymnast is traveling on will have a great impact on the length of each stride. The smoother the surface, the better the performance.

Students should graph the 5 trials. How similar are the trial results?

Students should create another table in their journals to show the distance traveled between each hesitation and stop. Ask students to calculate the distances and populate the table. Students should compare the distances.

Ask students:

- Is there a pattern? (Yes) If so, please describe the pattern.
- Why does the car's traveling distance decrease between each swing? (The pendulum slowly loses momentum due to friction on the wheels and axles, as well as air resistance, so it will come to a stop with the pendulum at its lowest point.)
- Can you create a formula that would generate the total distance that the car travels based on the distance it travels from the start to the first hesitation? (Formula depends on the data, but generally yes.)

Have students explain their observations, comparisons, and conclusions in their journals.

Lunch
Time: 30 minutes

Workplace Wellness: Physical Fitness
Time: 10 minutes
Materials:

- May vary depending on what activity is selected

Take a minute to complete a short physical activity. You may find several ideas for short physical activities for students through a simple web search. Ideas could include simple exercises like jumping jacks or running in place. Many companies encourage physical activity during the workday.

Team Briefing 3
Time: 5 minutes
Materials: None

Tell students:

You will change the ratchets and observe what happens. Remember that in all experiments, you must keep all but one variable constant. So, use a 90-degree angle on your gymnast for these trials.

Challenge 3: Gymnast Experiment 3
Time: 20 minutes
Materials:

- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals
- Measuring tapes

Ask students to flip out the back ratchet lever and flip in the front rachet lever. Tell them to predict what will happen in their journals. Then each partner should try the model, pulling the gymnast back 90-degrees.

Ask students what happened. (Gymnast went backward.)

Ask students to compare what happens when the gymnast is pulled forward 90-degrees and when the gymnast is pulled backward 90-degrees. Discuss the findings.

Tell students to fold-in both ratchet levers. Have students rest their hand against the back of the model. Again, have students pull the gymnast back 90-degrees. Have both partners take two turns.

Ask students:

- What did you observe when you released the gymnast with the car touching against your hand without the ratchet levers engaged? (There's an equal and opposite force, which you can feel as it presses against your hand when pushing off.)

Ask students
Team Brief 4
Time: 5 minutes

Say to students:

You have probably wanted to see what the maximum distance your car can travel. This is your chance! You will pull back the gymnast to its highest point – about 160 degrees and let the car travel as far as it can.

Challenge 4: Gymnast Experiment 4
Time: 30 minutes
Materials:

- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals
- Measuring tapes

Ask students to create a table in their journal of the total distance the car travels.

Set Up 1
Students should have both ratchet levers flipped in. Each partner should make two trials pulling the gymnast back to the fullest amount possible. Ask students to measure the farthest distance the gymnast moves for each trial. Students record the distances in their journals.

Set Up 2
Students should have the front ratchet lever flipped out and the back ratchet lever flipped in. Each partner should make five trials pulling the gymnast back to the fullest amount possible. Ask students to measure the farthest distance the gymnast moves for each trial. Students record the distances in their journals.

Set Up 3
Students should have the back ratchet lever flipped out and the front ratchet lever flipped in. Each partner should make five trials pulling the gymnast back to the fullest amount possible. Ask students to measure the farthest distance the gymnast moves for each trial. Students record the distances in their journals.

Set Up 4
Students should have both ratchet levers flipped in. Each partner should make two trials with their hand resting next to the back of the car and pulling the gymnast back to the fullest amount possible. Ask students to measure the farthest distance the gymnast moves for each trial. Students record the distances in their journals.

Team Brief 5
Time: 5 minutes
Say to students:

> *Now you will take information you have in your journals and compare and analyze the data. You will need to find the table you created from Experiment 2 that shows the distance traveled using a 90-degree angle. You will need to find the table you created from Experiment 4 that shows the distance traveled using the largest angle possible which is about 160 degrees. You will be creating a graph and determining how far the car moved on an x-y axis.*

Challenge 5: Gymnast Plotting Angle and Distance and Calculating Force
Time: 25 minutes
Materials:

- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals
- Graph paper
- Measuring tapes

Ask students to measure the height of the end of the gymnast's feet from the floor at 90 degrees and at the tallest height (largest angle). Tell them to write those heights in their journals.

Have students create a graph with one axis as the height of the feet and the other axis the distance traveled. Ask students to plot points for each height with the longest distance traveled (from their previously completed tables from Experiment 2 and Experiment 4). Have students add two more points. Students should choose two additional heights to release the gymnast from and then measure the distance. Each partner should make two trials and record the distances. Plot the height and distance traveled, using the longest distance.

Ask students to explain what the plot looks like and why.

Have students disassemble their models and put away the elements into the correct locations.

Daily Debrief and Wrap Up
Time: 20 minutes
Materials:

- Student journals

Have students write in their journals two things they learned today and if either of those things surprised them.

Ask students if any of them would be interested in working on full-scale models of propeller cars. Ask students what careers/jobs or career pathways would be important to the building of propeller cars?

Moving to the Victory Line Program Day 4

Olympic Event

Big Question:
How can force and motion be used in an Olympic event?

Materials needed for the day:

- BricQ Motion Prime sets
- Building Instruction Booklets
- BricQ Motion Prime Personal Learning Kits – one per student
- Student journals
- Chart paper
- Various craft materials
- Old magazines that can be cut up (optional)
- Pens
- Pencils
- Markers
- Glue sticks

Day 4: Outline for the Day

Outline of Day	Tasks	Time	Materials
9:00 - 10:50	Welcome	5 min	• Student journals
	Team building activity	20 min	• BricQ Motion Prime Set
	Review group rules and expectations and activities from yesterday	5 min	• Group Rules Chart
	Team Briefing 1	5 min	• None
	Research and Wonderings	20 min	• Discussion • Internet research • Student journals
	Inventory Check	15 min	• BricQ Motion Prime sets • Building Instruction Booklets

	Challenge 1: Calculating Force, Mass, and Acceleration	40 min	• Student journals
10:50 - 10:55	Break		
10:55 - 11:00	Team Brief 2	5 min	• None
11:00 - 11:55	Challenge 2: Gathering Ideas	20 min	• Student journals
	Team Brief 3	5 min	• None
	Challenge 3: Iterating to a Solution	30 min	• BricQ Motion Prime Personal Learning Kits • Student journals • Paper • Cardboard • Scissors • Markers • Tape • Measuring Tapes • Stop watches
11:55 - 12:00	Get ready for lunch		
12:00 - 12:30	Lunch		
12:30 - 2:10	Workplace Wellness (physical activity)	10	• Varies, based on the activity selected
	Team Brief 4	5 min	• None

	Challenge 4 Complete the Game	20 minutes	• BricQ Motion Prime Personal Learning Kits • Student journals • Paper • Cardboard • Scissors • Markers • Tape • Measuring Tapes • Stop watches
	Culminating Event – Be an Olympian	65 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals
2:10 - 2:30	Clean up Daily Debrief and Wrap Up Celebration	20 min	• BricQ Motion Prime sets • Building Instruction Booklets • Student journals

Welcome
Time: 5 minutes
Materials:

- Student journals

Welcome students back! Have each student share their ideas on what activities Collision Course could entail. Have them write one sentence in their journals about an object colliding with another.

Team Building Activity
Time: 20 minutes
Materials:

- BricQ Motion Prime Set

Create a Moveable Creature and an Event

Have each student create a movable robotic creature using the BricQ Motion Prime Set. Have them give their creature a name and a special characteristic. Have the pair create a an event that their creature could complete in. Have students share their creatures with another team. Ask students to write a paragraph in their journal about their creatures and the event.

Review group rules and expectations
Time: 5 minutes
Materials: Group Rules Chart

Quickly review the group rules and expectations. Highlight positive moments from Day 4 (times when students helped each other, asking great questions, teamwork, helping to clean up…)

Explain that they will have guests today and that they will be telling the guests about the cool new vehicle that they created. This will happen after lunch.

Team Brief 1
Time: 5 min
Materials: None

Say to students:

> *Welcome to the last day! Today is a great day for using your imagination, collaborating with others and having fun. Today's first challenge continues the study of force and motion. This time you will explore force, mass, and acceleration.*

Research and Wonderings
Time: 20 minutes
Materials:

- Discussion and Internet research
- Student journals

Have students research the formula for force, especially the force for a gymnast. Not all gymnast events are on the bars. Gymnasts also vault and do floor exercises and the rings. Ask students which laws of motion apply to gymnasts and to explain their answers.

Ask students what they information they need and how they could determine the mass or the acceleration. (They will not need to measure the mass or calculate the acceleration based on the model.)

Challenge 1: Calculating Force, Mass and Acceleration
Time: 30 minutes
Materials:

- BricQ Motion Prime sets
- Building Instruction Booklets
- Student journals

Tell students that Force is equal to Mass times Acceleration. For example, a gymnast on a bar starts at rest and accelerates at 10 m/s^2 (meters per second squared). That gymnast with a mass of 51 kg (kilograms) would have a force of 510 Newtons. Why? Because 51 x 10 m/s^2 = 510 Newtons.

Ask students to calculate the force of a gymnast who weighs 88 kg and accelerates at 10 m/s^2. (880 Newtons)

Ask students to calculate the force of a gymnast who weighs 74 kg and accelerates at 8 m/s^2. (592 Newtons)

Ask students to calculate the mass of a gymnast who accelerates at 10 m/s^2 and has a force of 630 Newtons. (63 kg)

Ask students to calculate the acceleration of a gymnast with a mass of 58 kg and has a force of 406 Newtons. (7 m/s^2)

Ask students to create 3 word problems and solve for the answers. One word problem each for determining the force, mass, and acceleration of a gymnast.

Inventory Check
Time: 15 minutes
Materials:

- BricQ Motion Prime sets

Have students confirm that all pieces in the bin and are in the correct tray compartments. Students should use the inventory card found under the lid to complete a full inventory. Place the completed sets away from access by students. They will not be using them for the remainder of the day.

> **Note:** If students are not receiving a Personal Learning Kit to use for the culminating activity, then skip this inventory check and place it at the end of the day.

Break
Time: 5 minutes

Team Brief 2
Time: 5 min
Materials: None

Tell students:

> *Your goal today will be to create an Olympic Event and then have other teams use a model to try and win gold! Before you start, you need some time to brainstorm, explore, and try out some ideas. Remember all the things you have learned over the course of this week and perhaps you still remember what you learned the first week. Use your journals to refresh your memory. Some examples are gears, slope, sails, propellers, and striking balls.*

Challenge 2: Gathering Ideas
Time: 20 minutes
Materials:

- Student journals

Have students brainstorm as a class some ideas for Olympic events that they could create. The events do not have to be current Olympic events or even current games or sports. The more creative the better. The event constraints are as follows:

- The models used in the event need to move.
- There must be rules and a way to quantify a score, measurement, time, etc. in order to determine winner.

Have teams write three ideas that they like into their journals. Ensure each team has three ideas.

Team Briefing 3
Time: 5 min
Materials: None

Tell students:
You now have three ideas to try. One of them is likely to be your finished game. However, as you work toward a solution, you may make modifications to your original ideas. Be creative. The game should be fun. Every team in the class will be playing the game, so make the rules clear and be certain the models will perform well.

Challenge 3: Iterating to a Solution
Time: 20 minutes
Materials:

- BricQ Motion Prime Personal Learning Kits
- Student journals
- Paper
- Cardboard
- Scissors
- Markers
- Tape
- Measuring Tapes
- Stop watches

Give each students one BricQ Motion Prime Personal Learning Kit. Tell each team these are the LEGO elements they will have access to for the rest of the day. (You may allow balls to be used. This is at your discretion. Just a reminder – the sets have been inventoried and are ready for a new set of students.) Students should have access to paper, cardboard, or other materials previously used. Tell students they will have some additional time after lunch to make sure the models and the rules are complete.

> **Note:** If students are not receiving a Personal Learning Kit to use for the culminating activity, then skip this inventory check and place it at the end of the day.

Lunch
Time: 30 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 may find several ideas for short physical activities for students through a simple web search. Ideas could include simple exercises like jumping jacks or running in place. Many companies encourage physical activity during the workday.

Team Brief 4
Time: 5 min
Materials: None

Tell students:

> *This afternoon you have a brief time to work on completing your models, rules, and so forth and test your game. Be aware that time is short because time is needed for everyone to play all games.*

Challenge 4 Complete the Game
Time: 20 min
Materials**:**

- BricQ Motion Prime Personal Learning Kits
- Student journals
- Paper
- Cardboard
- Scissors
- Markers
- Tape
- Measuring Tapes
- Stop watches

Complete the models and the rules of the game. Play one round with your partner and clarify the rules to make sure anyone can understand how to play.
Each team should:

- Name the game.
- Write directions on how to play.
- Write an explanation of how to score points and the object of the game.

Note: If students are not receiving a Personal Learning Kit to use for the culminating activity, then skip this inventory check and place it at the end of the day.

Culminating Project: Be An Olympian
Time: 65 minutes

Materials:

- BricQ Motion Prime Personal Learning Kits
- Student journals
- Paper
- Cardboard
- Scissors
- Markers
- Tape
- Measuring Tapes
- Stop watches

Have students introduce their event and briefly demonstrate and explain how the model works.

Pair two teams and have each team read through the written instructions and try to play the game. If questions arise, the team who created the game may make modifications to their instructions, models, and so forth. If another team gives them a good idea, the team receiving input should give them credit by making a note in their student journals.

Both teams should have played each other's games and they should be confident of the directions, models, and so forth for both games.

Have each team create a way to keep score (distance, time, etc.) for their game on chart paper. Tell students they when they play, they need to write their score, distance, time, etc. on the chart paper before moving to the next location as well as reset the materials to the original locations.

Determine a way for students to rotate through the room. Count the number of teams in the room and compute the time allowed per round. Each round, students play the game at a location then when time is up, they reset the game, then move to the next location. Students play all the games in the room. Allow students to play until time is up.

Have students take apart the models. Each student should have all the pieces for their personal learning kit. If students borrow materials from you (balls, tape measures, etc.) have them return all materials to you.

> **Note:** If students are not receiving a Personal Learning Kit to use for the culminating activity, then skip this inventory check and place it at the end of the day.

Cleanup, Daily Debrief, Wrap Up, and Celebrate
Time: 20 minutes
Materials:

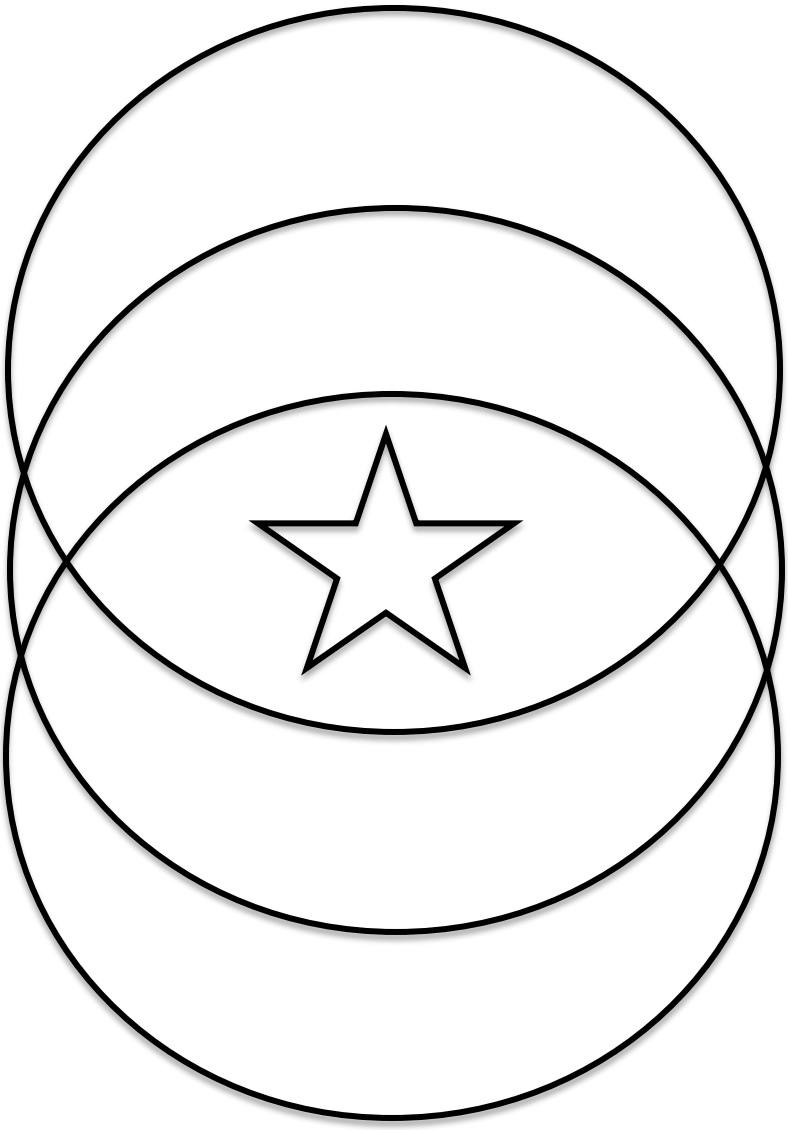
- Student journals
- 3 Award Templates for each team
- Colorful paper

- Scissors
- Markers
- Sticky notes
- Glue sticks

Have each team create an award for the top three players for their event. They can use the award template or create their own.

Clean up the work areas.

Award Template



Ask each team to announce the winners and give them the awards.

Ask students what games they enjoyed most and discuss why. Optional: Ask students what Olympic event they wish they could compete in and why they chose it.

Celebrate every student as a winner for using math, language arts and science this week. Students may take home their journals, awards, and BricQ Motion Personal Learning Kits.