Motion Unit Teacher Masters: Table of Contents

Introductory Letter to Families

Teacher Masters

Family Links

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ISBN 10: 1-59192-218-6 ISBN 13: 978-1-59192-218-6
2 3 4 5 6 7 8 9 10-BK1, 0912, D10652
www.sciencecompanion.com Chicago Educational Publishing Company, LLC.

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Dear Families,

Our class is beginning the Science Companion® Motion Unit. During this unit, children will explore a topic that is near and dear to them—motion! The Motion Unit offers an introduction to physics through activities that engage children's bodies and minds. In addition to inviting children to move their own bodies in various ways, the explorations in this unit involve building ramps, rolling toy cars, dropping and crashing marbles, sliding pennies and shoes, and even flying paper airplanes. Children will love these activities—and doing them will lead the children to think about the familiar topic of motion in new and "scientific" ways.

During the Motion Unit, the children will:

- Figure out different ways to make a toy car start moving and a ball change direction. Through these and other activities, they discover that all changes in motion are caused by pushes or pulls, also called forces.
- Compare the effects of big forces and small forces (pushes and pulls) on the motion of toy cars.
- Experiment with collisions between marbles on ramps.
- Experience the force of friction as they slide coins, shoes, and themselves.
- Drop marbles and other objects to explore the effects of gravity, another important force.

In addition to the work your child will do in class, you and your child can explore this rich topic together at home in the following ways:

- Visit the library and search for books about motion to read together and share with the class. There are book suggestions on the Science Companion web site. This web site also features a list of recommended web sites about motion. The address is: **www.sciencecompanion.com**.
- Work together on the Family Link activities that are sent home from time to time. Your child may also want to repeat and vary some of the activities we do in class, as well as explain what they discovered and learned. Try to encourage their independent experimentation at home.

Thinking and learning about how and why objects move the way they do is fascinating for children and adults—especially since we don't often take the time to think about these everyday occurrences. Hopefully, you will share some of your child's enthusiasm—you may even learn some new things, too!

Sincerely,

Heavy and Light Marbles—Falling

Predictions

Class Predictions

We will drop a heavy marble and a light marble from the same height and at the same time.

_____ people predict the heavy marble will land **first**.

_____ people predict the heavy marble will land **second**.

_____ people predict the heavy and light marbles will land at the **same time**.

Heavy and Light Marbles—Impact

Predictions

Class Predictions

We will drop a heavy marble and a light marble from the same height and at the same time.

_____ people predict the heavy marble will make a **bigger** hole.

_____ people predict the heavy marble will make a **smaller** hole.

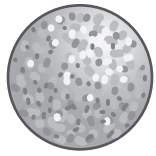
_____ people predict the heavy and light marbles will make the **same size** holes.

Heavy and Light Marbles—Falling

Observations

My Observations

1. The steel marble landed **before** / **after** / **at the same time as** the cork marble.

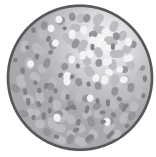



(circle one)

2. The steel marble landed **before** / **after** / **at the same time as** the glass marble.


(circle one)

3. The glass marble landed **before** / **after** / **at the same time as** the cork marble.

(circle one)

4. One glass marble landed **before** / **after** / **at the same time as** the other glass marble.

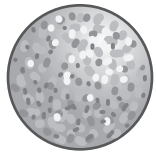

(circle one)

Heavy and Light Marbles—Impact

Observations

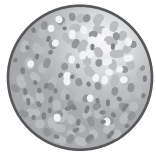
My Observations

1. The steel marble made **a bigger hole than** / **a smaller hole than** / **the same size hole as** (circle one) the cork marble did.



2. The steel marble made **a bigger hole than** / **a smaller hole than** / **the same size hole as** (circle one) the glass marble did.

3. The glass marble made **a bigger hole than** / **a smaller hole than** / **the same size hole as** (circle one) the cork marble did.



Sliding and Jumping—Indoors

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There are two activities at this station. In the first, children experience and discuss a sliding motion as they move across the floor. In the second, children jump and hop, and think about the forces involved in these motions.

In the sliding activity, the children experience the pushing force of their leg muscles and the force of friction. In the jumping activity, they experience the pushing force of their leg muscles and the pulling force of gravity.

Note: Some children will be more comfortable using the terms "push" and "pull" instead of "force."

Facilitate the following activities and discussions with the children at this station.

Activity 1: Sliding

Activity: Children take off their shoes and run and slide across the floor in their socks a couple times. As they slide, ask them to think about what makes it possible for them to slide and what makes them stop.

Discussion: Have children describe their motion, from starting to stopping point. Prompt them to include descriptions of distance, time, speed, path, and changes in speed or path. Also ask them to consider the pushes and pulls (or forces) that were involved in the sliding motion. The following questions might help spark their thinking:

- What made it possible for them to start moving? *(Their leg muscles provided the force that made them go forward.)*
- What made it possible for them to slide? *(There was not much friction between their socks and the floor, which enabled them to slide.)*
- Did they travel at the same speed the whole way? *(No)* If not, when did their speed change? What pushes or pulls caused their speed changes? *(Pushing harder with their muscles before they slid sped them up. Friction slowed them down as they slid.)*
- What made it possible for them to stop? *(The friction between the socks and the floor provided a force that slowly stopped them.)*
- Did their leg muscles provide a push or a pull? *(Push)*

Sliding and Jumping—Indoors

Activity 2–Jumping Up

Activity: Children jump up and down with both legs a few times, thinking about the distance, time, speed, and path of their motion, as well as the forces involved. Then they hop up and down on one leg and compare the two motions.

Discussion: Have the children describe their motion and identify some of the pushes and pulls that helped them start, change speed and direction, and stop. The following questions might enhance the discussion:

- How would they describe the path of motion?
- Did they travel any distance? *(Yes, even though they may have started and ended in the same place, they covered distance as they moved up and down along the path of motion.)* How might they figure out the distance?
- What made them go up in the air, or start moving? *(Leg muscles)*
- Were their leg muscles pushing or pulling? *(Pushing)*
- What happened to their legs muscles as they continued jumping? *(They got tired.)*
- What made them come back down? *(Gravity)*
- Was gravity pushing or pulling on them? *(Gravity was pulling them back to the ground.)*
- Can they jump as high with one leg as they can with two? *(No)* Why not? *(Because one leg isn't as strong as two, so it can't provide as much of a pushing force.)*

Sliding and Jumping—Outdoors

(Page 1 of 2)

There are two activities at this station. In the first, children experience and discuss a sliding motion as they move down a playground slide. In the second, children jump and hop, and think about the forces involved in these motions.

In the sliding activity, the children experience the pulling force of their arm muscles, the pushing force of their leg muscles, and the forces of friction and gravity. In the jumping activity, they experience the pushing force of their leg muscles and the pulling force of gravity.

Note: Some children will be more comfortable using the terms "push" and "pull" instead of "force."

Facilitate the following activities and discussions with the children at this station.

Activity 1: Sliding

Activity: One at a time, children climb the ladder to the top of the playground slide and then slide to the bottom. As they do this, direct them to pay attention to the forces involved when they climb and when they slide. If enough time is available, let them slide down a couple of times.

Discussion: Have children describe their motion, from starting to stopping point. Prompt them to include descriptions of distance, time, speed, path, and changes in speed or path. Also ask them to consider the pushes and pulls (or forces) that were involved in the sliding motion. These questions may be helpful:

- How were they able to climb up the ladder? *(By using their leg muscles on the steps and their arm muscles on the railings)*
- Were their legs and arms pushing or pulling? *(Their leg muscles pushed and their arm muscles pulled.)*
- Were there any forces pulling down on them as they climbed the ladder? *(Yes, gravity)*
- What forces (pushes or pulls) acted on them as they slid down? *(Gravity and friction)*
- Can they think of ways they could slow down their speed as they slide? *(They might try increasing the amount of friction by putting their feet or hands, or both, on the slide. Children may have other ideas as well.)* Why might these actions work to change their motion?

Sliding and Jumping—Outdoors

Activity 2–Jumping Up

Activity: Children jump up and down with both legs a few times, thinking about the distance, time, speed, and path of their motion, as well as the forces involved. Then they hop up and down on one leg and compare the two motions.

Discussion: Have the children describe their motion and identify some of the pushes and pulls that helped them start, change speed and direction, and stop. The following questions might enhance the discussion:

- How would they describe the path of motion?
- Did they travel any distance? *(Yes, even though they may have started and ended in the same place, they covered distance as they moved up and down along the path of motion.)* How might they figure out the distance?
- What made them go up in the air, or start moving? *(Leg muscles)*
- Were their leg muscles pushing or pulling? *(Pushing)*
- What happened to their legs muscles as they continued jumping? *(They got tired.)*
- What made them come back down? *(Gravity)*
- Was gravity pushing or pulling on them? *(Gravity was pulling them back to the ground.)*
- Can they jump as high with one leg as they can with two? *(No)* Why not? *(Because one leg isn't as strong as two, so it can't provide as much of a pushing force.)*

Experimenting with Collisions

(Page 1 of 2)

There are two activities at this station. In the first activity, children roll two balls towards each other until they collide. In the second activity, children bounce balls off the ground or a wall.

In the first activity, children experience the pushing forces that result from the collisions, as well as the force of friction. In the second activity, children experience the forces exerted by their arm muscles, the wall or floor, and gravity. In both activities, the children will observe and describe interesting changes in the ball's path and speed of motion that result from the forces that are acting.

Note: Some children will be more comfortable using the terms "push" and "pull" instead of "force."

Facilitate the following activities and discussions with the children at this station.

Activity 1: Balls Colliding With Each Other

Activity: Half of the group stands on either side of the designated space. Children on each side take turns with the balls to create the following collisions:

- One child places a stationary ball about 1 m (3 ft) in front of him or her. A child from the opposite side rolls their ball until it hits the stationary ball.
- Two children across from each other roll their balls at the same speed and at the same time directly toward the other's ball so they collide in the middle. They may need a "roll" signal and a few tries to get the speed close to the same.
- Two children across from each other roll their balls at the same time directly toward the other's ball, but one child rolls their ball slowly while the other rolls their ball as fast as they can.
- Two children across from each other roll their balls at the same time at an angle, trying to make the balls collide off to the side between them.

Management Note: Have the children repeat each of the collision trials several times. Discuss each collision before moving on to the next type of collision.

Discussion: After each type of collision, encourage children to describe and analyze the motion of the balls by asking some of the following questions:

- What happened to each of the balls? *(They hit and moved away from each other.)* What was the path of each of the balls before and after the collision? Did they seem to change speed before or after the collision?
- After the collision, were the balls moving because of a push or a pull? *(A push)*

Experimenting with Collisions

(Page 2 of 2)

- How did the speed of each rolling ball change the way that the balls moved after they were hit? *(A faster moving ball collides with more force than a slower moving ball. A ball hit by a faster moving ball will move farther and faster than a ball hit by a slower moving ball.)*
- Did the direction from which the balls were rolled change the way the balls moved after they hit? *(Answers may vary or include different observations.)*
- After the balls collided, did you think they would move the way they did? Why or why not?
- Why did the balls eventually stop moving? *(They may have stopped due to friction or they may have stopped after bumping into something or someone, which exerted a force that stopped the motion.)*

Activity 2—Balls Colliding with Other Solid Surfaces

Activity: Each child takes at least one turn doing the following:

- Bouncing a ball on the floor or ground
- Rolling a ball along the floor or ground so that it bounces off the wall

Discussion: While children are waiting for a turn with the ball, involve them in a conversation about what they think is happening to the motion of the ball and what forces are causing any changes. Probe with some of the following questions:

- What happened to the ball when someone first threw it or rolled it? *(It started moving. They pushed it.)*
- What happened to the ball when it hit the floor, ground, or wall? *(It bounced and changed direction. When the ball hit the surface, the wall or floor pushed on it.)*
- Where did the ball move to? What was its path of motion? *(From the floor or ground, it moved up, back to them, etc.; from the wall, it moved out, back to them, etc.)*
- What are some of the forces that were acting on the ball? *(Arm muscles were pushing, the wall and the floor were pushing, gravity was pulling down, etc.)*

Using Balances and Scales

1. I have two vegetables. One is a(n) _____ and the other is a(n) _____.

2. Which vegetable **feels** heavier? _____.

3. My balance looks like this one: (circle one)



Draw a picture of your vegetables in the balance pans.

4. Which vegetable is heavier?_____

5. The balloon weighs more less than the marbles.
(circle one)

6. Are larger objects always heavier than smaller ones? _____

7. My pencil weighs about _____ grams.

Family Link with Science

Searching for Motion

Tell your family about the Motion Search we went on at school. Then, teach someone in your family how to be a "motion detective" and have a motion search at home.

Look for interesting examples of motion indoors or outdoors. Write down some of the examples you see. Include a drawing if you'd like. Be sure to describe the following, using words, pictures, or both:

- What moved
- How it moved
- Where it moved
- How fast it moved
- How far it moved
- How long it moved
- How its motion changed

You can use the back of this sheet or add other sheets for your examples.

Family Link with Science

Measuring Hand Strength

Today in science we learned a way to measure muscle strength and force. Work together to measure and record the hand strength of people in your family. To measure hand strength:

1. Hold a bathroom scale upright, like a book, in front of you with both hands. Squeeze the scale as hard as you can.
2. Read and record the weight that the scale shows.
3. Repeat for another family member. (You can add results for more family members on the back of the page.)

Family Member's Name	Hand Strength (kg or lb)
_____	_____
_____	_____
_____	_____

Return to school by _____