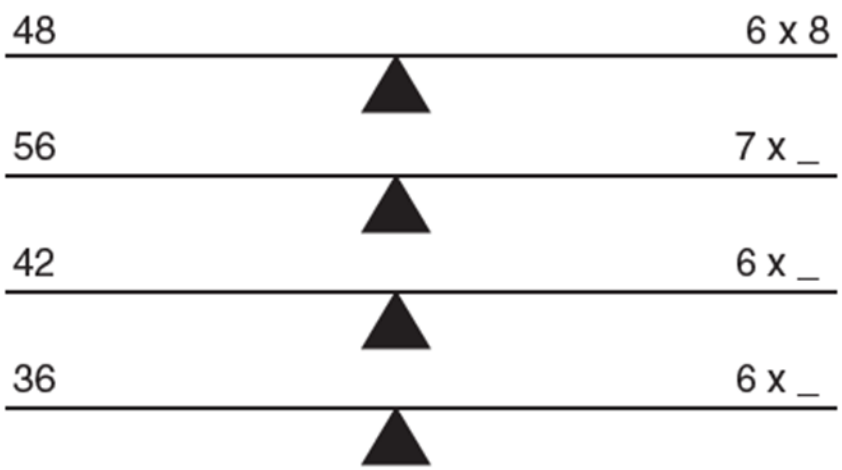
Cross-Curricular Activities Connected to Physical Science, Grade 3

The following activities from ***Forces and Interactions,*** integrate math, social studies, English Language Arts (ELA), art, and more into physical science topics. These cross-curricular connections help students see how science is related to their lives, and the world they live in. These activities reinforce and extend ideas about interactions of forces and are perfect for learning-from-home lesson plans. Permission is granted to incorporate these activities into teacher and parent lesson plans.

Balancing Expressions (Math)

Draw the scales below on the board. Challenge students to complete the expression to balance each. The first one is completed as an example. If students need help, remind them that they can divide to find the missing multiples. (Answers are 8, 7, and 6, respectively.)



Isaac Newton and the Laws of Motion: Inventions and Discoveries (ELA and Social Studies)

Obtain four copies of the graphic novel Isaac Newton and the Laws of Motion by Andrea Gianopoulos. Divide the class into four groups. Have each group read one of the four chapters in the book, and then prepare and present a brief summary of the major inventions and discoveries by Newton discussed in the chapter. After each group has presented its summary, create a timeline of Newton's inventions on a bulletin board to display in the classroom for the remainder of the unit.

Tug-of-War (Movement Education)

Tug-of-war is a balancing game. A line is drawn on the ground between two teams, each of which holds one end of a rope. Each team tugs or pulls its end of the rope to see which team can apply a stronger force and move the other team across the line. Set ground rules to manage behaviors, and then take students to the gym or playground to play. Divide the class into two groups of equal strength. Lay a long rope on the ground and instruct each group to line up at opposite ends. Make a line on the ground between the two groups with tape. instruct groups to pull simultaneously on the rope and try to apply enough force to move the other team across the line. The team that is able to pull the other across the line will have applied a stronger force. Sometimes during tug-of-war, neither team will move even though both sides are pulling. In this case, both teams are applying the same amount of force. If this happens with your class, point out that neither team is moving because they are creating balanced forces.

Crash Test Dummies (Science)

SAFE Laboratories tests and reports on the safety of vehicles. Locate a video that shows what happens to objects inside a moving vehicle that comes to an abrupt stop. Let your class watch inertia in action, and then discuss the effects of inertia and what students can do to make sure they remain safe in an automobile.

Friction Forces—Story Problems (Math)

Share the following story problem with the class, and then challenge them to answer the questions.

Tripp, Cindy, Reed, and Diane were working on an engineering project to show the concept of friction. They built two motorized vehicles with rubber tires. Vehicle A was tested on a smooth, linoleum surface. Vehicle B was tested on a rough, carpeted surface.

1. Both vehicles traveled the same distance, but Vehicle A traveled for 30 seconds while Vehicle B traveled for 40 seconds. How much longer was Vehicle B in motion than Vehicle A? (Vehicle B traveled 10 seconds longer than Vehicle A: 40 sec – 30 sec = 10 sec)

2. Convert the seconds that each vehicle traveled into minutes by dividing and creating a fraction and a decimal. (Vehicle A traveled 30/60 seconds, or half a minute, or 0.5 minute. Vehicle B traveled 40/60 seconds, or two-thirds minute, or 0.67 minute.)

3. Even though both cars traveled the same distance, explain which vehicle was more affected by friction and why. (Vehicle B was affected more by friction because the surface it traveled on was rougher. The more friction there is acting against the motion of the moving vehicle, the slower the vehicle travels.)

Gravity Is a Mystery (Literacy)

Read aloud Gravity Is a Mystery (Let's-Read-and- Find-Out Science 2) by Franklyn M. Branley. Discuss with students how the graphics and illustrations help them understand concepts such as gravity and inertia. Then, have students work in pairs to draw and label a diagram explaining a concept from the book and share it with the class.

Inertia "Magic" (Science)

Sometimes what appears to be magic can be explained by a science concept. Place a tablecloth on top of a desk. Have students set plastic objects on top of the tablecloth. Then, pull the tablecloth off quickly in a direction parallel to the table. The plastic objects will stay in place because of the "magic" of inertia.

How Many Grams? (Math)

Present students with the following story problem:

When experimenting with forces at the science center, Kevin, Cameron, and Tana planned a physics experiment using toy cars. They gathered three toy cars that were identical in size and mass. Tana found three washers in an envelope. One washer had “1 gram” etched into it. Tana placed that washer on a green car. A second washer had “6 grams” etched into it. Cameron placed that washer on a red car. The third washer had no etching. Kevin placed this washer on a purple car. Kevin, Tana, and Cameron raced their cars on a track. The purple car moved three times faster than the green car. The red car moved twice as fast as the purple car. What was the mass of the washer on the purple car?

Help students find the mass of the car using the following equations:

The purple car moved 3 times as fast as the green car, which had a 1-gram washer.

$1\ g \times 3\ g = 3$ grams

The purple car moved at half the speed of the red car, which had a 6-gram washer.

$6g \div 2g = 3$ grams

Art in Motion (Social Studies and Art)

Italian painter Giacomo Balla (1871–1958) was one of the founding members of the Futurist Painters. This group of artists was interested in using light and shapes to show speed and movement in their artwork. Look for a few of Giacomo Balla’s paintings online and, as a class, explore each painting that you select. Discuss how it depicts movement. You might want to point out that in each, repetitive and overlapping shapes and lines as well as the use of light paint next to dark gives an illusion of movement. After viewing the artwork, provide students with large paper and paint and have them create their own motion paintings.

Forces Make Things Move (ELA)

Read Forces Make Things Move (Let's-Read-and-Find-Out Science 2) by Kimberly Brubaker Bradley aloud to the class. Consider having several copies available so groups of students can read the book together as they complete the vocabulary activity below.

Reinforce important vocabulary such as "forces," "reactions," "inertia," "friction," and "gravity" by having students create illustrated flash cards. Have students write one word and its definition on the back of each of five index cards. They may use the book as reference for definitions if needed. On the front of each card, have students draw an image or diagram illustrating the word defined on the back.

Have students quiz each other using the completed flash cards.

Make a Splash (Art)

Place a large piece of bulletin board paper on the ground in a parking lot or playground. Pour blobs of different-colored tempera paint onto the paper. Have each student drop a ball from a different height into the paint. (Make sure students wear paint shirts or plastic ponchos so they do not get paint on their clothing.)

Discuss the differences in the size or shape created when the paint splashed from the force of the ball. Students should notice that the higher the height from which they release the ball, the faster the ball is moving when it hits the paint. This greater speed of the ball results in a more forceful impact and a bigger splash. Ask a volunteer to record the height from which each ball is dropped and a description of the paint splash that results.

Clean up and wash the balls when you are finished. Dry the splash painting overnight and then display it in the classroom. Invite students to label the splash painting based on their notes.

Find Your Way with Magnets (Science and Engineering)

It is possible to create a compass by magnetizing a paper clip. Provide pairs of students with a ring magnet, a paper clip, a 7.5-cm piece of string or thread, a pair of scissors, a straw, and a large paper cup.

Guide students to assemble a compass using the steps below:

1. Straighten the paper clip and stroke its entire length with the ring magnet approximately 40–50 times until the paper clip is magnetized (acts like a magnet on its own).
2. Remove the bottom from the paper cup.
3. Poke a hole in each side of the paper cup about one-quarter of the way from the top of the cup.
4. Slide the straw through the holes in the cup.
5. Tie the string to the center of the straw.
6. Tie one end of the string to the paper clip. The paper clip should be able to move and spin freely inside the cup.

As a class, use the completed compasses to determine the direction of true North or all four directions relative to your location. Explain that the magnetized paper clip will naturally align with Earth's magnetic field, providing a North–South reading.

Paper Clip Collection (Math)

Have students collect data from testing the strength of two different types of magnets to determine which magnet is stronger. Challenge them to use each magnet to attract as many paper clips at once as possible. Students should count the number of paper clips attracted to each magnet and draw a scaled picture graph to show the data. Ask them to write and solve an addition equation to determine how many more paper clips were attracted by the stronger of the two magnets.

Comparing Books about Magnets (ELA)

Obtain at least one copy of each of the following books:

- What Magnets Can Do (Rookie Read- About Science) by Allan Fowler
- Magnets: Pulling Together, Pushing Apart (Amazing Science) by Natalie M. Rosinsky
- Magnets (All Aboard Science Reader) by Anne Schreiber

Divide the class into three groups and allow time for each group to read its assigned text. (Note: These texts are listed from low to high reading level. You may want to group students by ability, or you may want to combine high-ability and low-ability students in each group for peer teaching.)

After each group has explored its text, bring the class together for a discussion. Create a three-column chart on the board. Title each column with one book title. Ask each group to share how its book presented information about poles, magnetic fields, and attracting and repelling. (Students may give an example from the book, read a definition, or tell how diagrams or other graphics showed the concept.) Record students' responses on the chart. When the chart is complete, compare the information presented in each of the books.

Negative and Positive Charge Challenge (Science)

Make available the materials from Investigation D of this lesson and challenge students to design an investigation to determine what would happen if the large, negatively charged styrene ball came close to a small, positively charged styrene ball on the balance. Have students test and then explain the results of their investigation.

Inventors and Inventions (Literacy)

Have available at least one copy of each of the following books:

Gravity by Jason Chin

Pull: The Magnetism Files by Adam Rankin

Friction by Matt Mullins

Divide the class into three groups and assign a book to each. Direct groups to explore their text and to each choose one new fact about their book's subject to share with the class. Adequate time should be given for students to locate and write down a new fact.

Inertia (ELA and Math)

Read Inertia by Tom Sibila to the class. Discuss how the illustrations in the book help the reader understand the principle of inertia. Have students write an explanatory paragraph about the law of inertia. Ask them to include illustrations that help describe and explain the concept.

F = ma

Remind students that Sir Isaac Newton is remembered and honored for formulating the three laws of motion. Then write "Newton" on the board and circle the capital N. Tell students that the unit by which we measure force—the newton—was named in Newton's honor. It is abbreviated as N.

Write the formula F = ma on the board, and explain that the F stands for force (in Newtons), the m stands for mass (in kilograms), and the a stands for the rate of acceleration (in meters per second squared, or SI).

Ask students to use the formula F = ma to calculate answers to the following questions. Assist students in setting up the equations.

1. An object's mass is 6 kilograms, and its acceleration is 4 SI. What is its force?

   (F = 4 x 6. Force is 24 newtons)

2. An object's mass is 10 kilograms, and its acceleration is 7 SI. What is its force?

   (F = 10 x 7. Force is 70 newtons)

3. An object's mass is 3 kilograms, and its acceleration is 9 SI. What is its force?

   (F = 9 x 3. Force is 27 newtons)

Balloon Racers (Engineering)

Search for a video of a "Balloon Racer" competition, a humorous exercise based on Sir Isaac Newton's third law of motion. You might provide time in class for students to design and build racers or have them design and build racers at home and bring them to class for the competition.