

**Title:** FANTASTIC FRICTION!!!

Brooke Pegher

**Problem to be studied: Effects and Causes of Friction**

**Content Standard(s):** 3.4C Understand that changes in motion are due to effects of force

**Content Objective (s):** The students will understand that changes in motion are due to the effects of friction and that friction is a force that opposes motion. The students will understand that friction is caused by changes in surface texture and amount of force pressing objects together.

**Process Standard(s):**

- 3.2.4A Identify and use the nature of scientific and technological knowledge.
- 3.2.4C Recognize and use the elements of scientific inquiry to solve problems.
- 3.2.4D Technological Design

**Process Objective(s):** The students will complete lab reports showing predictions, observations and conclusions of lab results. The students will design an experiment that shows how friction and surface texture can increase and decrease motion.

**Assessment Strategies: (Evaluation)**

**Formative Evaluation:**

1. The teacher will observe for accuracy and understanding during the design and carry-out of student created experiment.
2. The teacher will ask students questions about their lab reports and seek explanations of results.
3. The teacher will ask students to explain the car design and to provide rationale for modifications used.

**Summative Evaluation:**

1. The teacher will collect the students lab sheets and check for accuracy
2. The students will use the rubric given for their object modifications
3. The students will record in their journals the following information:
  - a. Modifications made to object
  - b. Reasoning behind modification
  - c. Result of modification on speed
  - d. Drawing of designs with labels
  - e. Student reflections on process

**Procedures:**

**Engage:** As small groups the students will list at least 10 items that have movement or motion. Groups will choose one item from the list to use as topic for the following questions: How does this item move? How can we slow down the movement? How can we speed up the movement?

Groups will share their findings- teacher will post answers on the board by putting into one of two unlabeled columns (will become “surface texture” and “amount of force” later).

**Suggested Grade Level:**

3,4,5

**Materials:**

**Activity 1/Per Group:**

- 2 matchbox cars
- yardstick
- stopwatch
- textured materials
- board/ramp
- set height stack of books

**Activity 2/Per Group:**

- Yardstick
- Set weight stack of books
- Stopwatch

**Final Activity/Per Group:**

- Stopwatch
- Board
- Books
- Ramp
- Textured materials
- Items that can move
- “box of goodies”
- items with weight: paperclips, washers, pennies, marbles

## *Lesson Plan*

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**Explore:** As groups the students will complete activities that show the effect of surface texture and amount of force on motion. Each student will record in their journal the following: prediction about motion, materials used, observations, data table and conclusions of results.

**Activity One:** Challenge Question: Which race car is the fastest? Can you speed up and slow down your car?

Station Materials: 2 matchbox cars, textured materials and fabric, yardstick, stopwatch, board, books set to specific height for ramp board

**Activity Two:** Challenge Question: How quickly can you move books the length of the yardstick using only your pinky?

Station Materials: 5 large textbooks, yardstick, and stopwatch

**Explain:** Groups will share their findings/ results with the rest of the class. Teacher will facilitate discussion toward comparing the modifications of activities with non-identifies lists on board (surface texture and amount of force). Children will work towards realizing:

- that the cars went faster will a smoother surface
- that the cars went slower with increased texture
- that as books were added to stack (increasing the force), it became harder to move the stack
- that as the stack was increased the amount of time also increased

Teacher will provide labels on board for columns of “surface texture” and “amount of force”.

Teacher will facilitate discussion of definition similar to: “The amount of friction depends on surface material and force pressing objects together. The greater the amount of friction the harder/slower an object moves, the smaller the amount of friction the faster/easier an object moves.”

**Elaborate:** Students will design an experiment using the textured materials (surface) and weights (amount of force) provided to design an experiment showing how to increase the motion of an object and how to decrease the motion of an object. The students will record all steps and observations in their journal, with a reflection of activities to be collected.

### **Related Web Sites:**

Experiment with weights/books- needs modified for inquiry!:

<http://www.galaxy.net/~k12/machines/frict1.shtml>

Real life applications- ideas from kids!

<http://www.reachoutmichigan.org/funexperiments/quick/dirtmeister/friction.html>

Connect to simple machines:

<http://www.ccet.ua.edu/student/6machinesstudinfo.htm>

Forces and Motion theme page:

[http://www.cln.org/themes/force\\_motion.html](http://www.cln.org/themes/force_motion.html)

Virtual Lab:

<http://www.hazelwood.k12.mo.us/~grichert/sciweb/mechanic.htm>

### **Sources consulted in developing this lesson:**

**STC Motion and Design kit**

**PEGHER 500**



### **The Context:**

Winning a NASCAR race depends on many factors, including the speed at which the racecar can perform. Car designers and engineers need to create cars that help the driver win the race.

### **The Situation:**

You are a member of a race car design team. The car you have been given was previously used on a farm. Your team needs to modify the car to increase the speed and distance the car can travel in a 5 second time period.

### **Limitations:**

- Each modification must be tested in a fair test and contain at least 3 trials.
- A graph of results must be created.
- The road surface may not be altered.
- The car must carry the weight of 2 quarters (weight of driver)

### **Rules:**

- You must modify your car at least 2 times.
- All cars must start from a ramp height of 6 inches, using the ramp provided.
- You may alter your car by adding or subtracting parts.