FRICTION
CINNY WEST
BOWLING GREEN JR HIGH

MAJOR CONCEPT: Students will learn the causes of friction and how friction can be overcome. Students will observe the effects of friction and design ways to overcome friction through experimentation.

CONTENT & VOCABULARY: Types of forces (gravitational, frictional, balanced, unbalanced), types of frictional forces (sliding, rolling, fluid). Friction Facts: Friction opposes motion, Friction causes heat, Friction causes surfaces to wear away.

CORE CONTENT: SC-M-1.2.2 An object remains at rest or maintains a constant speed and direction of motion unless an unbalanced force acts on it. SC-M-1.2.3 When an unbalanced force acts on an object, the change in speed and/or direction depends on the size and direction of the force.

SKILLS: Comprehension, application, analysis

CHALLENGE: Predict which type of surface would decrease friction the most.

BACKGROUND: You will need to have already discussed balanced and unbalanced forces and be introducing friction as a type of force.

TASK 1: After discussing friction and giving several demonstrations I divide the students into two groups and have them debate the statement "Friction does more harm than good". I assign one half of the class to be pro friction and the other half con friction. This is a good way to get the students to start thinking about friction as not always being a bad thing. I have the students work in smaller groups to complete the worksheet "Challenge Your Thinking" then we have the class debate. I usually give the "Friction" worksheet as homework.

TASK 2: Slip and Slide

Follow the direction for Slip and Slide. The research step should be filled in using the notes and debate from the day before. I usually tape down newspaper to the desks because the oil tends to get everywhere. It is very important that the students make their hypothesis and sticks to it. I love this lab because the outcome is totally unexpected. Most students predict that the transparency with oil or aluminum foil with oil will be the slipperiest. Actually what happens is the plain white paper or plain aluminum foil is the slipperiest. The oil acts as an adhesive on the surfaces!!! After gathering their data, students should complete the bar graph and answer the analysis questions. I have the students write their conclusion for homework. See attached rubric to score lab.

TASK 3: EVALUATION/ORQ

See attached open response question and rubric. I use this type of rubric on most of my ORQ. It works really well. This is how I use this. As I read the open response I use a highlighter marker and mark the categories that are being addressed. If I end up with more highlighter in the apprentice column, then the student scores apprentice. If there is more in the proficient column then the student scores proficient and so on. I go ahead and include the distinguished column as the ideal. I assign a score to each column; usually 95-100 for distinguished, 94-88 proficient, 87-75 apprentice, 74-70 novice. If the answer totally does not make sense but at least they wrote something I give at least a 65. No answer is always a zero.

Slip and Slide

Name _____

Problem: What type of surface would be the best for the slipperiest slide?

Research: _____

_____

_____

_____

_____

Hypothesis: _____

_____

_____

Materials: masking tape, paint stirrers, film canister, 10 pennies, vegetable oil, large wooden protractor (or you can make a protractor out of card stock), 4 strips of the following: plain paper, transparency film, aluminum foil, sandpaper.

Procedure:

1. Tape the paper strip to the top side of the paint stirrer.
2. Place the film canister filled with 10 pennies on top of the paper strip.
3. Position the paint stirrer and canister beside the protractor.
4. Slowly raise the free end of the paint stirrer until the canister begins to slide.
5. Measure and record the angle at which the canister begins to slide. Record your results.
6. The paint stirrer is again placed flat on the table with the film canister in its original position and 2 through 4 are repeated 2 more times. Record your results.
7. The angles are totaled, averaged and recorded on the data table.
8. Repeat steps 1-6 for the transparency film, aluminum foil, and the sandpaper and record on the data table.

   YOU MAY CONTINUE ONLY IF YOU HAVE COMPLETED ALL OF THE ABOVE STEPS.

9. Heavily lubricate each strip of material and the bottom of the canister with vegetable oil.
10. Repeat steps 1-6 with the lubricant. Record the measurements on the second data table.

10. Throw away all material that has been lubricated with oil (all 4 strips of material and the canister). Restock all materials in your basket and replace the pennies in a new film canister.
11. Make a colored bar graph of your results.

Data/Analysis:

Using the data tables and the bar graphs, answer the following questions.

1. What material allowed the canister to slip at the lowest angle?

2. What material allowed the canister to slip at the highest angle?

3. What material caused the least friction? How do you know this?

4. How did the lubricant affect friction on each of the four materials?

5. What problems were created when applying the lubricant? Could these problems be overcome?

6. What does the bar graph tell you?

7. Why did you have to do each test 3 times?

Conclusion: Answer the problem statement. Accept or reject your hypothesis. Identify the variable in this experiment.

Name (5 Points) _____
Research (5 Points) _____
Hypothesis (5 Points) _____
If then statement
Data collected (5 points) _____
Data total and averaged (10 pts) _____
Answer all question correctly (20 pts) _____
Conclusion (25 points) _____
Variable
Controls
Errors
Answers the problem statement
Accepts or rejects hypothesis

TOTAL (75 POINTS) _____

SLIP AND SLIDE RUBRIC

Name (5 Points) _____
Research (5 Points) _____
Hypothesis (5 Points) _____
If then statement
Data collected (5 points) _____
Data total and averaged (10 pts) _____
Answer all question correctly (20 pts) _____
Conclusion (25 points) _____
Variable
Controls
Errors
Answers the problem statement
Accepts or rejects hypothesis

TOTAL (75 POINTS) _____

FRICTION OPEN RESPONSE

We have been studying the effects of friction on moving objects. Friction affects every moving object on the Earth's surface. Even something as simple as riding your bike can produce many different types of frictional forces. But is friction a friend or a foe?

Look at the diagram below. At point E, the brake pad is rubbing against the tire. This friction causes the bike to stop. In this case friction is definitely a friend.

A. Identify two other areas where friction is a friend. Describe the two surfaces rubbing together, what they cause and why they are a friend.
B. Identity two areas where friction is a foe. Describe the two surfaces rubbing together, what they cause, why they are a foe.
C. Explain ways that you could "fight the foe" when friction is not opposes motion.