**STATIC AND KINETIC FRICTION**

**Investigation Designer: John O’Donnell**

 **Grade level: High School Introductory Physics**

 **Time Required: 3 hours**

Confirmation Structured Guided Open

**Investigation Focus: Mechanics and Forces, friction force**

**State Learning Standards:**

**1. Motion and Forces**

**1.5 Free-body force diagrams show forces acting on a system consisting of a pair of interacting objects.**

**1.6 Qualitative differences between static and kinetic friction, and their effects on the motion of objects.**

**Materials List:**

* Various similar objects with different masses
* Spring scales
* Notebooks
* Connected to ISENSE project #636

**Engaging Experience:**

**Instructor will set up an experiment at the front of the class, using a wood block and a wooden plank. The instructor will mass the block, and then either weigh it or convert mass to weight by multiplying by 9.81. The instructor will then attach a spring scale to the block (by any appropriate method), and pull gradually on the spring scale until the block starts to move. At the point it moves, the instructor will note the force on the spring scale (it will tend to bounce) and call it out. Then, pulling steadily at constant speed, the instructor will read off the force on the spring scale, which will be somewhat less. (NOTE: It is important to use a scale appropriately matched to the mass of the object in order to correctly read the forces.)**

**Guiding Question(s):**

1. **Why does it take less force to keep an object moving than to start the object moving?**
2. **Why does the type of surface affect friction?**

**Investigations:**

**See the file: Static and Kinetic Friction**

**Present Findings and Draw Conclusions:**

Each team will present their data and defend their conclusions

**Assessment:**

Peer Presentation Rubric

Investigation Presentation Rubric

**Resources:**

ISENSE Project 636

**Wrap Up:**

1. How is friction necessary in your everyday life? Give three examples, with an explanation for each.
2. What shape would be best for an object travelling at highway speed to reduce friction? How could you prove your hypothesis?
3. Modify this experiment so that instead of using a spring scale to measure force, use an inclined board and a protractor. Write a procedure for this experiment, including how you would record and analyze your data.