Name

Exploring Forces

Station A: Dominoes

- Set up and knock down Dominoes a few times with your team.

1. Draw a force diagram for one of your Dominoes before it fell.

2. Draw a force diagram for a Domino as it was falling.

3. Draw a force diagram for your Dominoes on the table after they fell.

Station B: Golf Ball Roll

Golf balls experience very little friction when rolling along a hard surface.

- Roll the golf ball across the room.
- Do the same for the ping pong ball.

Analysis:

4. How does this demo show Newton’s first law of motion?

5. Draw a force diagram for when you are pushing the golf ball.

6. Draw a force diagram while the ball is moving at a constant speed and direction.

7. Label the diagrams as balanced and/or unbalanced forces.

Station C: Ball Drop

Directions:

- Watch the marker cap trick video (https://www.youtube.com/watch?v=uOSBC0SXVR4) and replicate the experiment with a ball

Analysis:

15. How does this demo show Newton's first law of motion?

16. Why does the marker cap not move to side?

17. Draw a force diagram before the ring is removed.

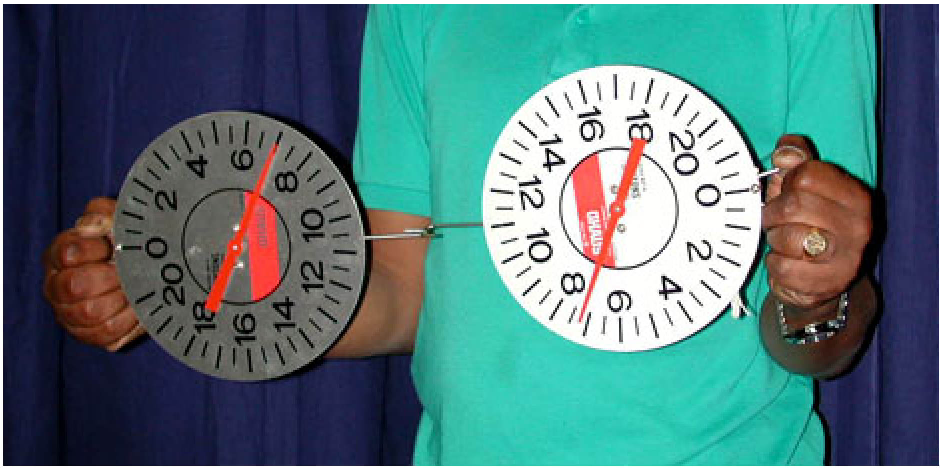
18. Draw a force body diagram just after the ring is removed.

Station D: Force and Springs

Materials: Momentum Cart, Spring scale, Hanging Masses

Procedure:

1. Connect two spring scales together as shown below:



Can you make the spring scales show different values? Explain why you think this is true.

1. One side of the spring scale has lines and numbers which measure force in units of Newtons (N). The reading tells you the size of the force that the spring is pulling with. The more the spring is stretched, the harder it pulls back. Hang a hanging mass from the bottom hook and write the force reading below:

2. As the hanging mass is hanging from the hook motionless, what must the net force acting on it be according to Newton?

3. Name all of the forces acting on the hanging mass.

Station E: Friction

Materials: 2.5N spring scale, Block of wood with hook, Hanging Masses

Procedure

1. Use your spring scale to find the mass (in grams) of your block of wood and write it here:

2. Now use the spring scale to pull the block of wood with a slow constant velocity across the table. What is the size (in Newtons) of the force the spring pulls with?

3. Make a list of all of the forces that are acting on the block of wood as it is being pulled.

4. Draw a picture of the block of wood and indicate each force with an arrow.

5. Can you figure out the size (in Newtons) of the force of friction acting on the block? (Hint: Use your drawing from #4 to find the answer, knowing that net force is zero.)

6. Use the spring scale to find the weight of hanging mass (write here):

7. Put the hanging mass on top of the wooden block and repeat the above experiment from #2. Now how big is the size (in Newtons) of the force of friction acting on the block?

8. Can you see a relationship between the force of friction and the total mass of the thing you are pulling (block plus hanging mass)? If so, what is it?

9. Repeat the above experiment, but this time watch the spring scale very carefully as you slowly increase the force while the block is initially at rest. Compare the size of the force of friction just before the block starts to slide (this is static friction) to the size of the force of friction when the block is sliding with constant velocity (this is kinetic friction). Repeat a few times to be sure. Record observations in space below:

10. Finally, repeat the above experiment on another surface (for example the floor or a notebook). Does the amount of friction depend on the nature of the surfaces involved?