Physics

Finding Friction

Name:_____ Block:_____

Friction is the force that is created when two objects move against each other. You can calculate this force by multiplying the *coefficient of friction (μ)* by the normal force (F_N). The coefficient of friction changes based on what the two objects that are in contact with each other are. A high friction coefficient makes objects difficult to move while a low friction coefficient allows things to move very easily. Below are some frictional coefficients that you will need to use today.

Coefficient of Friction Values (μ)		
Objects being tested	**Surfaces Used**	
	Wood	Metal
Rubber	.7	.5
Wood	.3	.45
Sponge	.41	.34
Glass	.22	.19
Cork	.5	.3
Plastic	.28	.25
copper	.26	.4

Today you will explore friction by playing at four different stations: driving, slipping, spinning, & sliding.

Materials

- Toy car
  - Tennis shoes
    - Tennis ball
      - Cookie sheet
      - Wood block
      - Cork
- Tile
  - Socks
    - Rubber ball
      - Glass jar
      - Sponge
      - Penny
- Carpet square
  - Sink full of water
    - Wood board
    - Eraser
    - Rubber stopper
    - Plastic cap

Procedures

Station 1: Driving

At this station, you will observe how the toy car behaves on two different surfaces. Give the car a push across the tile and observe what happens. Then, give the car a push across the carpet and observe what happens. Write down your observations. Identify if the coefficient of friction is high or low (relatively speaking) between the car and the carpet & tile.

Station 2: Slipping

At this station, you will observe how two different objects behave on the same surface, the tile floor. Someone wearing tennis shoes (rubber soles) will get a running start and try to slide across the floor. Observe what happens. Do you slide? Then, the same person will remove their shoes, get a running start and try to slide across the floor in their socks. Observe what happens. Do you slide? Identify if the coefficient of friction is high or low (relatively speaking) between the tile and the rubber soles & socks (probably cotton).

Station 3: Spinning

At this station, you will observe how spinning in water affects two different types/textures of ball. The sink is already filled with water. You will need a tennis ball and a rubber ball. Place one of the balls in the water and then spin it. Observe what happens. How long does it take to stop spinning? Now, take the other ball, place it in the water and spin it. How long does it take to stop spinning? Identify if the coefficient of friction is high or low (relatively speaking) between the water and the rubber ball & tennis ball.

Station 4:Sliding

At this station, you will observe how various types of objects compare on two different surfaces, and then you will calculate the frictional force (F_f) acting on that object. Recall that weight (W) is equal to the mass of an object multiplied by gravity (W=mg), and that weight and the normal force balance each other ($W=F_N$). The formula for calculating the frictional force is: $F_f=\mu F_N$.

1. Choose one of the objects to be tested and mass it using the electronic balance.
2. Place it at the end of the wood board and slowly lift up that end.
3. Observe what happens. Record some observations in Table 1.
4. Record the data in Table 2 below.
5. Place the object at the end of the cookie sheet and slowly lift up that end.
6. Observe what happens. Record some observation in Table 1.
7. Record the data in the Table 3 below.
8. Repeat steps 1-7 with all of the objects being tested.

Table 1: Observations

	Observations on:	
Object	**Wood Board**	**Cookie Sheet**
Cork		
Eraser		
Glass bottle		
Penny		
Plastic cap		
Rubber stopper		
Sponge		
Wood block		

Table 2: Wood Board

Object	Mass (g)	Mass (**kg**)	$F_N = W = mg$	μ	$F_f = \mu F_N$
Cork					
Eraser					
Glass bottle					
Penny					
Plastic cap					
Rubber stopper					
Sponge					
Wood block					

Table 3: Cookie Sheet

Object	Mass (g)	Mass (**kg**)	$F_N = W = mg$	μ	$F_f = \mu F_N$
Cork					
Eraser					
Glass bottle					
Penny					
Plastic cap					
Rubber stopper					
Sponge					
Wood block					

Questions

1. Explain why the car travels further on the tile than on the carpet square.

2. Explain why you were unable to slide wearing rubber soled shoes.

3. Explain why the tennis ball stopped spinning before the rubber ball.

4. Arrange the items from Station 4 in order of increasing frictional force that had to be overcome. In other words, arrange all 16 combinations in order from smallest F_f to largest F_f.