# SPASH PHYSICS QUICKIE LAB
## FRICTION IS FUN (or f = u N)

Name _____ # ____ Name _____ # ____

**Purposes:**

1). To compare starting friction with sliding friction.
2). To determine whether how fast one surface is moving over another surface changes the frictional force.
3) To determine if friction depends on the area of contact or not. Meaning does the coefficient of friction change whether an object is on its small side or its wide side.
4). To determine if you place more mass on the surfaces in contact if the coefficient of friction between the two objects changes.
5). To determine if the nature of the surfaces in contact and the smoothness of the surfaces effects the coefficient of friction.

**Procedure:**

1). Calibrate two spring scales to zero. One that maybe measures up to 5N and the other 10N or more.
2). Choose a block surface and choose a track surface to pull it across for each of the upcoming tables. Note three different pairs in each table.
3). Hook a spring scale to the front of a block and record the applied force (scale reading) just before the object slides and then the reading as the object slides at a constant speed.
4). Fill in columns 3 and 4 for three different pairs of surfaces in Table 1 below repeating steps 1 thru 3 above. Use the results for question 1 below.
5). Now record in Table 1, columns 5 and 6 for three different pairs of surfaces again the applied force as you pull the object at a slow constant speed and a medium constant speed. Use the results to answer question 2 below. Note: All future Applied Forces will be sliding applied forces.
6) Now record in Table 2: EFFECT OF SURFACE AREA the measured block mass and applied force then calculate the block weight and coefficient of friction. Use the results to answer question 3 below.
7). Now record in Table 3 the block mass, added mass (use a small and a medium mass), and applied force then calculate the Total Mass, Total Weight, and Coefficient of Friction. Use the results to answer questions 4 and 5 below.
8). Finish answering the questions.
9). Hand in quickie lab.

Due Thurs end of period.

Table 1 (Static vs. Kinetic Friction and Effect of Speed)

| Trial | Block Surface | Track Surface | (measured) Starting Applied Force (N) | (measured) Sliding Applied Force (N) | (measured) Applied Force (N) (slow speed) | (measured) Applied Force (N) (mod.speed) |
|---|---|---|---|---|---|---|
| 1 | Plast | Nylon | 1.1 | 1.3 | 1.3 | 2 |
| 2 | " | | | | | |
| 3 | " | | | | | |

Table 2 (Effect of Surface Area)

| Trial | Block Surface | Track Surface | Surface Size | (measured) Block Mass (kg) | (calculated) Block Weight (N) | (measured) Applied Force (N) | (calculated) Coeff. u |
|---|---|---|---|---|---|---|---|
| 1a | " | | small | .5kg | 4.9 | 1.3 | |
| 1b | " | | large | " | " | 2.0 | |
| 2a | " | | small | " | " | | |
| 2b | " | | large | " | " | | |
| 3a | " | | small | " | " | | |
| 3b | " | | large | " | " | | |

$f = \mu N$ so $\mu = \frac{f}{N} = \frac{\text{spring scale}}{\text{weight}}$


Table 3: Effect of Mass

| Trial | Block Surface | Track Surface | (measured) Block Mass (kg) | (measured) Added Mass (kg) | (cal.) Total Mass (kg) | (cal.) Total Weight (N) | (measured) Applied Force (N) | (cal.) Coeff. u |
|---|---|---|---|---|---|---|---|---|
| 1a | | | .574 | s .251 | .825 | | | |
| 1b | | | " | m .491 | | | | |
| 1c | | | " | l .961 | | | | |
| 2a | | | " | s | | | | |
| 2b | | | " | m | | | | |
| 2c | | | " | l | | | | |
| 3a | | | " | s | | | | |
| 3b | | | " | m | | | | |
| 3c | | | " | l | | | | |

## Calculations

$F_w = m\ g = m\ (9.8\ m/s^2)$

$F_{friction} = F_f = u\ F_{Normal} = u\ F_N = u\ N = u\ m\ g = u\ m\ (9.8\ m/s^2)$

So since $F_f = u\ N$ then $u = F_f / N$ or $u = F_f / (mg)$

## Questions:

1. Discuss how static (starting from rest) friction compares to kinetic (moving) friction? (Table 1 columns 3 & 4)

2. Discuss the effects of different constant speeds (slow vs. moderate)? (Table 1 columns 5 & 6)

3. Discuss the effects of surface area? (Table 2)

4. Discuss the effects of the friction on the force pressing the two surfaces together? (Table 3)

5. Discuss the effect on the coefficient of friction with added mass? (Table 3)

6. Discuss the effect on friction with the nature of the surfaces in contact and the smoothness of the surface? (All tables overall)