

Name: _____ Date: _____

Friction Worksheet

Draw Free-body diagrams and use Newton's laws of Motion to solve the following problems.

1. A 10 kg box rests on the ground.
 - a. What is the weight of the box? What is the normal force of the ground on the box?(98 N , 98 N)
 - b. The box is pushed to the left with 20 N of force, but does not move. What is the Static Friction Force? (20 N)
 - c. When the pushing force is increased to 40 N, the box just begins to move. What is the Maximum Static Friction Force?(40 N)
 - d. What is the co-efficient of Static Friction (μ_s) between the ground and box?($.41$)

2. A sled is pulled horizontally across the snow at constant velocity. The pulling force is 40 N.
 - a. What is the Kinetic Frictional Force on the Sled?(40 N)
 - b. If the weight of the sled is 200 N, what is the co-efficient of Kinetic Friction (μ_k) between the sled and snow?(0.20)
 - c. If 30 kg of wood is placed in the sled, what pulling force is needed to move the sled at constant velocity?(98.8 N)

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3. A 0.5 kg hockey puck slides across the ice starting with a velocity of 5 m/s. The puck slides and slows for 100 meters under constant acceleration and then stops.

- What is the acceleration of the hockey puck? ($.125 \text{ m/s}^2$)
- What Kinetic Frictional Force is needed? (0.0625 N)
- What is the co-efficient of friction between the ice and puck? ($.013$)
- Recalculate a, b & c for a 1 kg hockey puck. (Does the weight change a or c?)

4. The tires on a 500 kg race car have a co-efficient of Static Friction (μ_s) of 1.8. (We can use static friction while tires are rolling, i.e. not moving relative to the ground. If the car skids, then we would use kinetic friction)

- What is the maximum braking force (Static Friction) that can be applied to the car? (8820 N)
- What is the acceleration of the car during braking? (17.64 m/s^2)
- If the race car has wings which increase the downward force by 4000 N, what is the maximum braking force? What is the acceleration of the car during braking? (16020 N , 32.04 m/s^2)
- Return to the situation of the race car without wings. What is the braking force during skidding (i.e. kinetic frictional force) if the co-efficient of Kinetic Friction (μ_k) = 1.2? What is the acceleration of the car during skidding? (5880 N , 11.76 m/s^2)
(Does this tell you why drivers avoid skidding to decrease stopping distance?)