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, 98N)*
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.
a. What is the acceleration of the hockey puck? *(.125 m/s^2)*
b. What Kinetic Frictional Force is needed?*(0.0625N)*
c. What is the co-efficient of friction between the ice and puck?*(.013)*
d. 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)
a. What is the maximum braking force (Static Friction) that can be applied to the car?*(8820 N)*
b. What is the acceleration of the car during braking? *(17.64m/s^2)*
c. 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)*
d. 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?)