



Name: \_\_\_\_\_

## Forces and Friction

1. A little boy pushes a 12 kg. box of library books with a constant velocity along the side walk by applying a horizontal force of 96N. Draw a free body diagram for the box. Calculate the weight, Normal force, frictional force and coefficient of friction between the box and the sidewalk.
2. A museum curator pulls a 1470 N sculpture across the museum floor, with an acceleration of  $0.5\text{m/s}^2$ . If the coefficient of sliding friction between the floor and the sculpture is 0.57, calculate the mass, normal force, force of friction, and the force with which the curator pushes the sculpture.
3. A 20kg boy on a 5 kg skateboard coasts to a rest from a speed of 4.5m/s while traveling a distance of 20m on the sidewalk. Draw a free body diagram for this situation and calculate the acceleration of the skateboard, the force of friction on the skate board and the coefficient of friction between the skateboard and the sidewalk.
4. Johnny lets a 0.5kg ball roll on the floor of the classroom. The ball gradually slows down. The coefficient of friction between the floor and the ball is 0.18. Draw a free body diagram and calculate the acceleration of the ball.
5. A traveller at Newark airport pulls his 294N suitcase with constant velocity to the check-in counter applying a force of 159N at an angle of  $37^\circ$  with the horizontal. Calculate the Normal force, frictional force and the coefficient of friction between the suitcase and the airport floor.
6. A mother pushes her 9.5 kg baby in her 5kg baby carriage over the grass with a force of 110N at an angle of  $30^\circ$  with the horizontal. If the coefficient of friction between the wheels of the carriage and the grass is 0.14, calculate the weight, normal force, frictional force and the acceleration of the carriage.
7. The steepest street in the world is Baldwin Street in Dunedin, NZ. It is inclined at an angle of  $38^\circ$ , with the horizontal. A child slides down the street with a constant velocity on a sled with high friction runners. What is the coefficient of friction between the sled runners and the street?
8. A light drivable car with a mass of 9.5kg was built in London. The wheels of this car are locked, so that they no longer roll. If the car is now pushed up a 300 slope by an applied force of 80.0N, with an acceleration of  $1.64\text{ m/s}^2$ , what is the coefficient of kinetic friction between the car and the incline?
9. The record speed for grass skiing was set in 1985 by Klaus Spinka as he skied down a 340 incline. If the coefficient of kinetic friction between the skis and the grass was 0.198, what was Spinka's acceleration? If he started from rest, how fast was he moving after 6.6s?
10. Suppose that the most massive car ever built is moving down a 10.00 slope when the driver applies the brakes. The net force acting on the car as it stops is  $-2.00 \times 10^4\text{ N}$ . If the coefficient of kinetic friction between the car's tires and pavement is 0.797, find the car's mass. What is the normal force that the pavement exerts on the car?