611-0045 (40-218) Halls Car with Aluminum Wheels

Introduction: for centuries basic physics experiments have been performed with the idea that friction is not a factor in the outcome. Sadly, this is not the case. Friction can ruin even the best-planned experiment. While it is possible to account for friction mathematically, the easiest way to get around it is to reduce it as much as possible. With that aim in mind, we have developed our aluminum wheeled halls car. Using three piece aluminum wheels running on PTFE cone bearings, our car is nearly frictionless. Its precise weight of 100g allows for easy calculations. The large 2.75 x 2.75 inch tray easily accommodates four one-inch cubes.

The Halls Car can be used in the same way as our standard 611-0040 Halls Car. Its advantages however, are lower friction and more precise mass.

Operation: Our Halls car helps teach the concepts of work, energy, conservation of momentum, simple machine and many others. It is best used with an inclined plane, weights and pulleys. Suggested experiment:

1. Load the car with weights
2. Weigh the car on a balance
3. Attach a string to the hole on the Halls Car.
4. Elevate your inclined plane to an angle of approximately 15 degrees. Make sure the string pulling the car is parallel to the plane.
5. Give the car a slight push to get it started. Determine the force required to pull the car up the incline by adjusting the weights needed.
6. Remove enough weight so the car rolls down the plane at a slow uniform speed after being started. This is the force of rolling friction, the force that holds back the car from rolling down the incline.
7. Measure the length of the inclined plane and the height between the two ends.
8. Repeat for other angles, such as 35 and 65 degrees.
9. Determine at what angle the car tends to remain stationary for a given load. At this point the weight in the pan equals the weight of the load in the Halls car times the tangent of the angle of the incline. The tangent of the angle of the incline equals the Coefficient of friction. This value is the relation of the force of friction to the force perpendicular to the surface. In this instance, the body being studied rolls by means of wheels instead of sliding, and the rolling friction between the wheels and plane, as well as the sliding friction on the axle of the wheel, are factors to consider.
10. Remove the string from the car. Keep the same weight (if any) in the well of the car.
11. Decrease the angle of the inclined plane until the car just barely rolls down the plane at uniform speed after being given a small push. Make sure there are no obstacles.
12. Measure the height between the two ends of the plane and the length of the base. This is another way of calculating the Coefficient of Rolling Friction.

13. Turn the car upside down and set it upon the inclined plane to study sliding friction.
14. Close the inclined plane completely and begin to raise it slowly. Determine the force needed to just start the upside down car from a position of rest. This is the force of static friction.

Warranty and Parts:
We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

May we suggest:

611-0035 Inclined Plane: Solid aluminum plane & accessories. Investigate acceleration, friction, gravity, Galileo's free-fall experiments. Folds for storage, clamps to 45°, features protractor and pulley.

611-0050 Weight Pan: Durable wire hanger is bent at just the right angle to hold our plastic pan upright. Designed for use with our inclined planes, we're sure you can find many other uses