Name:

AP Physics C
M. Lam

Gravity-Powered Car

Block:

Objective

To design and build a vehicle, powered solely by the gravitational potential energy of a 1 kg lab weight that will travel the greatest linear distance.

Construction Rules

- The vehicle must be powered by the gravitational potential energy of a provided 1 kg lab weight.
- The vehicle cannot have any additional potential or kinetic energy at the start other than what can be stored by the provided 1 kg lab weight.
- The vehicle's dimensions must not exceed 50 cm in length or width, and 100 cm in height.
- The vehicle must have at least 3 wheels. A wheel is defined as any object that can rotate about an axis and makes contact with the floor at all times.
- The propulsion of the vehicle must be a direct result of Newton's Third Law of Motion between the floor and the wheels of the car. In other words, no part of the vehicle may push (or pull) off any surface other than the floor beneath the car.
- All parts of the vehicle—including the weight—must remain with the vehicle as it travels down the track and stops.
- The vehicle must be self-starting and may not receive a push in the forward direction or side direction.
- The vehicle must be fully autonomous after if leaves the start line.

Figure 1: A 1 kg cast iron lab weight. Its gravitational potential energy will be the sole power source for the vehicle.

Car Testing

1. The vehicle must be registered on the competition date. All vehicles will be inspected to ensure that all contestants have met the construction rules.
2. The course will be the length of the hallway and 2 meters wide.
3. The vehicle will be started from rest with the front axel centered over the starting line.
4. The distance traveled will be measured along the center-line of the track, from the starting line to the point of contact between the wheel farthest from the starting point and the floor.
5. Any vehicle that exits the track before coming to a complete stop will have its exit point marked and the distance traveled measured from the starting line along the center-line to the adjacent exit point.
6. Each vehicle will complete two runs. The better of the two runs will be recorded.

Scoring

A score will be given by the formula

$$\text{score} = 50 + 50\sqrt[3]{\frac{d}{25}}$$

where *d* is the distance travelled in metres.

Vehicles that do not meet design requirements will not receive the base 50 points.

Vehicles will receive a grade equal to the score from the above formula or placing among all contestants, whichever is higher.

Place	Grade
1st	100
2nd	98
3rd	96
4th	94
5th	92