

# Physics Project: Falling Mass Powered Car

**Purpose:** To design and build a vehicle powered by a falling mass that will successfully move a vehicle over a specified distance.

**Partners:** Students must work in table groups.

**Rules:**

1. Maximum Dimensions: 0.3 meters (length) x 0.3 meters (width) x 0.6 meters (height)
2. Maximum Falling Mass: 2000 g = 2 kg (student brought masses will be checked before competition)
3. Materials: any available material may be used
4. Minimum Number of Wheels: 3 (all must be functional)
5. Vehicle must not tip/fall over during its run.
6. Vehicle must start from rest.
7. Vehicle must have a starting mechanism.
8. Vehicle must get its power from only the falling mass that is a part of the vehicle.

**Anatomy of a Falling Mass Car:**

A basic falling mass powered vehicle consists of the following basic parts: a chassis, a drive mechanism, wheels and the driver's compartment. If proper care is not used to ensure that each system is functioning at its peak, your vehicle may not perform adequately, or at all.

**The Chassis:** The chassis is the part of your vehicle to which all other parts are mounted. It consists of a form defining frame and any necessary support structures for your other systems.

**Keys to success:**

1. **Make it true** – vehicles that run straight have the best chance
2. **Make it light** – lighter vehicles will travel farther with less force
3. **Make it adjustable** – things do not always go as planned

**The Drive Mechanism:** Without a drive mechanism your vehicle is nothing more than an over-engineered paper weight. The drive system is the heart of a successful vehicle. Great care and thought should be taken to design and build it right.

**Keys to success:**

1. **Take advantage of physics**
2. **High highs and low lows** – the secret to a strong drive mechanism is squeezing the most energy from the falling mass. You want to get the mass as close to the ground as possible.
3. **Choose your design carefully.**

**The Starting Mechanism:** Your vehicle must have some type of starting mechanism. You can utilize a trap door, a pulled pin, a removable chock, etc. You may not drop the mass by hand.

**The Wheels:** Do not write off the wheels as superfluous detail, they are just as important as the rest of your vehicle, and remember all wheels have to be functional.

**Keys to success:**

1. **Light and Straight:** keep your wheels as light and strong as possible. Make sure they are mounted perpendicular to the axle and true to the center so they do not wobble as they roll which uses up energy.
2. **Friction:** Your wheels need to have friction with the floor (so they can grip it), but your axles need to have as little friction as possible.
3. **Size Matters:** The diameter of your wheel is a major factor in overall performance.

## **Assessment:**

### **1. Design**

- Students are to build their own vehicles.
- Students will submit design drawings showing a side view and overhead view.
- Vehicles should be identical in design to submitted diagrams (add in modifications if needed)
- Designs must conform to specifications as outlined in the rules section.

### **2. Distance Competition & Stability**

- Student vehicles must travel a straight line distance of 10 meters on the due date to receive full credit.
- Vehicles traveling shorter distances will result in a loss of points.
- *Vehicles must travel a minimum of 5m or they will not receive credit for this project.*
- All or nothing; your vehicle must not tip/fall over during its run.
- Vehicles will race in heats of two. Winners move on to next heat. Winner is first to cross finish line or furthest distance travelled if neither car crosses finish line.

### **3. Participation/Sportsmanship/Deadlines**

- Students receive credit by completing the assignment
- Students exhibit sportsmanship during the competition phases.
- Students should be supportive and offer assistance whenever possible.
- Students receive full credit for meeting all assigned deadlines.