

Electric Car

Name:

Block:

Objective

To design and build a motorized car, powered solely by the energy of up to two standard 9-volt batteries.

Construction Rules

- The car must be powered by a maximum of two standard 9-volt batteries from either Duracell or Energizer. No other makes or types will be allowed, even if rated for 9 volts.
- The car and motor must be designed and built by the team. Pre-manufactured cars and motors will be disqualified. Device components that are pre-manufactured may be used.
- The car cannot have any additional potential or kinetic energy at the start other than what is stored in the battery.
- The propulsion of the car 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 car may push (or pull) off any surface other than the floor beneath the car.
- The car must have a single activation switch, such as an electrical switch or a mechanical release lever, which starts the motor.
- The car must have a suitable location for a load consisting of laboratory weights to be placed.
- All parts of the car must remain with the car as it travels down the track.
- The car must be self-starting and may not receive a push in the forward direction or side direction.
- The car must be fully autonomous after it leaves the start line.



Figure 1: Allowed 9-volt batteries: standard Duracell or Energizer only. Up to two batteries are allowed.

Car Testing

1. The car must be registered on the competition date. All cars will be inspected to ensure that all contestants have met the construction rules.
2. The course will be 5 m in length and 2 meters wide.
3. The mass of the load will be declared and then placed on the car.
4. The car will be started with the front of the load centered over the starting line.
5. The car will be started using a single switch.
6. A successful attempt is one in which the car carries load across the 5 m finish line.
7. An attempt in which the car that does not travel 5 m or exits the track before the 5 m will be considered a failed attempt.
8. Each car will complete two runs. The better of the two runs will be recorded.

Scoring

Cars will receive a grade based on either the maximum load carried or placing among all contestants, whichever is higher.

Load (rounded down)	Grade
1 kg	100
900 g	99
800 g	98
700 g	97
600 g	96
500 g	95
400 g	94
300 g	93
200 g	92
100 g	91
0 g	90
Moving Car¹	80
Rolling Chassis w/ Motor²	70
Rolling Chassis w/o Motors³	50
Disallowed Cars⁴	<50

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

¹ A motorized car that moves at least 30 cm but does not meet the minimum distance requirement of 5 m earns an 80.

² A rolling chassis with a working motor that meets all design requirements and rolls 2.5 meters with a reasonable push earns a 70.

³ A rolling chassis without a motor that meets all other design requirements and rolls 2.5 meters with a reasonable push earns a 50.

⁴ Cars that do not meet design requirements are scaled between 0 and 50. A car that carries a 1 kg load a distance of 5 m earns a 50; a car that travels 5 m without a load earns a 45; a car that travels less than minimum distance earns a 40; a rolling chassis with a working motor earns a 35; a rolling chassis without a motor earns a 25.

Bonus points will be awarded for cars able to carry a load greater than 1 kg. For loads greater than 1 kg, the grade will be determined using the following formula

$$\text{grade} = 100 + 20 \log m$$

where m is the maximum load in kg.