

## 8.7 Investigation: Measuring Force and Speed of Geared Cars

### Questions to Answer

What's the best way to build a car to go uphill?

What factors affect how strong the car will be?

Are fast cars strong Cars?

How does the gear ratio on a car affect its speed and strength?

### Discussion

Its nice to have a fast car, but often more speed means less strength or force. Factors such as wheel size, weight and gear ratios may have an affect. Also energy changes are important, so that the most efficient car will maintain speed and force.  $\text{Power} = \text{Force} \times \text{velocity}$  The higher the power the more efficient the car is.

We can measure force or strength of a car by pulling on it with a force sensor or spring balance as it tries to move away.

We can measure its speed using a timer or motion sensor.

### Aim

**Investigate what factors affect the speed and strength of electric motor cars**

### Equipment

- Small DC motor car made from kits or from a Project.
- Stopwatch and ruler or motion sensor
- Spring balance or force sensor



### Procedure

Build a battery powered car.

Choose **one** of the variables below that will affect power and speed of a car:

***Weight, Wheel size, Gear ratio***

### Make a prediction:

The greater the \_\_\_\_\_ the greater/less the speed of the car.

Also the greater \_\_\_\_\_ the greater/less the strength of the car

#### 1. Test speed:

- a. Record the first measure of the variable (initial weight, wheel size or gear ratio)
- b. Run the car and use a stopwatch and measure average speed for a marked out distance e.g. 3 metres

**OR** Use a motion sensor and software and run for 3 seconds.  
Repeat this for the same conditions.

2. Test Strength:

Use a spring balance hooked onto the car and hold it back from moving.

OR Use a force sensor and software and find average force while it runs over 3 seconds. Measure average force required

3. Retest the speed and strength for a change in the variable. Record the second measure of your variable. Repeat at least once.

4. Record all results.

**Results**

**1. Speed**

What I will change;	Speed			Strength		
	Test 1	Test 2	Average	Test 1	Test 2	Average
Weight or wheel size or gear ratio						
First measure:						
Second Measure:						

**Conclusion**

1. Did your results prove you were right?
2. Why did it work/ not work?
3. Check other students results to make conclusions about all three possible factors:
  1. Weigh affects on speed and strength?
  2. Wheel size affects on speed and strength?

3. Gear ratios (Gearing up or down) affects on wheel size and strength?
  
4. Decide what would be the best configuration for an uphill climber:
  1. Gears
  2. Weight
  3. Wheel Size