

**Your Name:** Jane Doe

**Your School:** Asimov HS

**Your School's JSJS Mentor:** Neil deGrasse Tyson

**Original Research Topic:**

Car Cooling using Compressed Air – Stationary (engine off)

**Background Information:**

Bahrain has extremely high summer temperatures making cars very hot. This is particularly true for a car sitting in the sun (e.g. in mall parking lot, driveway, parallel parked, etc.)

Compressed gases in general have a tendency to cool when released. This can be explained using the combined gas law of ideal gases:

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Where P = pressure, V = volume, and T = time.

When a compressed gas is released, the pressure decreases faster than the volume can increase, so the temperature must drop. The compressed air cooling system relies on this effect to cool the car. Using a compressor, air can be released in 10 second bursts into the car and the effect on temperature can be measured.

**Background Research:**

Oxford Business Group. (2010). *The Report Bahrain 2010*.

Gaines, L., Levinson, T., & McConnell, S. (n.d.). To Idle or Not To Idle: That Is The Question. Retrieved January 15, 2015, from <http://www.transportation.anl.gov/pdfs/EE/642.PDF>

Alternative Fuels Data Center. (2014, October 29). Fuel Properties Comparison. Retrieved January 15, 2015, from [http://www.afdc.energy.gov/fuels/fuel\\_comparison\\_chart.pdf](http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf)

**Testable Question:**

Will increasing the time between air bursts lead to a lower final temperature?

**Independent Variable:**

Length of Time Between Bursts from Compressor into car.

**Dependent Variable:**

Temperature inside the car

**Materials:**

Materials I will provide	Needed Materials (provided by the school)
Car	Temperature Probe - 3
	Lab Quest 2
	Air Compressor

**Procedure:**

- Parked car outside in the sunlight
- Three temperature probes placed in the following positions: One outside the car, another hanging just inside the passenger window, and the last on the driver seat (when referring to the car's overall temperature, the temperature value from the probe on the driver's seat is being used).
- The temperature probes were connected to Lab Quest 2.
- An air compressor with a tank was placed beside the car and connected to a hose with a valve at the end that could be opened to release compressed air.
- Let temperature inside car stabilize.
- Compress air to set PSI value (8 PSI for example)
- Compressor then turned off
- Compressed air probe aimed through the passenger window at the temperature probe hanging inside the window.
- Compressed air released in 3 bursts of 10 seconds each, with the gap between bursts changing for each test (independent variable).
- The temperature for each of the three probes recorded for 150 seconds (or time needed to release all the air for the longest test), with a data point being collected each second.
- After each test, the temperature inside the car was given time to stabilize before testing again.

**Are there additional materials needed for this experiment that cannot be provided by the school? If so, please list them here and include a link to a source with a cost estimate.**

Compressor with 20 gallon tank \$299.00 USD - <http://www.amazon.com/dp/B00CAI5GRC>

Hose \$40.08 USD - [http://www.amazon.com/Snap-On-870218-Accessories-8-Inch-50-Feet/dp/B007H2NSQ2/ref=pd\\_sim\\_469\\_2?ie=UTF8&dpID=51qxZrC%2BQ%2BL&dpSrc=sims&preST=AC\\_UL160\\_SR133%2C160\\_&refRID=1XQ0YTRZPXCGY7WH1YAN](http://www.amazon.com/Snap-On-870218-Accessories-8-Inch-50-Feet/dp/B007H2NSQ2/ref=pd_sim_469_2?ie=UTF8&dpID=51qxZrC%2BQ%2BL&dpSrc=sims&preST=AC_UL160_SR133%2C160_&refRID=1XQ0YTRZPXCGY7WH1YAN)

**List any supporting attachments you would like reviewed in evaluating your proposal:**

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