


# Short Performance Assessment: HS-PS2-1

Grade Level: **High School**

Adapted from [SNAP](#)<sup>1</sup>

Title	<b>Are Porsche's Claims Warranted?</b>		
Designed by	<b>Randy Gunnell, Justin King, Carol Giles, Angela Lukaszewski, Christopher Zangler-Scaduto, Jason Lindley</b>	Course(s)	<b>NGSS Physics</b>
Edited by	<b>Paul Andersen &amp; Andy George</b>		
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Performance Expectation	<p><b>HS-PS2-1:</b> Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.</p> <p><b>Clarification Statement:</b> Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.</p> <p><b>Assessment Boundary:</b> Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.</p>
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Science and Engineering Practice	<p><b>Analyzing and Interpreting Data</b></p> <ul style="list-style-type: none"><li>Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.</li></ul>
Disciplinary Core Ideas	<p><b>PS2.A: Forces and Motion</b></p> <ul style="list-style-type: none"><li>Newton's second law accurately predicts changes in the motion of macroscopic objects.</li></ul>
Crosscutting Concept	<p><b>Cause and Effect</b></p> <ul style="list-style-type: none"><li>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.</li></ul>

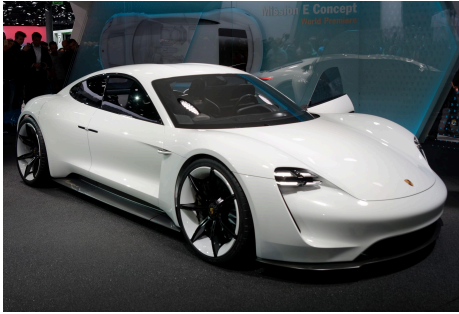
Student Performance	<ol style="list-style-type: none"><li>Organizing data</li><li>Identifying relationships</li><li>Interpreting data</li></ol>
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<sup>1</sup> The Short Performance Assessment (SPA) and the Assessment Rubric adapted from the Stanford NGSS Assessment Project <http://snappgse.stanford.edu/>



Name\_\_\_\_\_

## Are Porsche's Claims Warranted?



A [report](#) published in Car & Driver, with information provided by Porsche, makes some outlandish claims regarding the performance of their new electric vehicle called the Taycan. Porsche claims to have collected these data points on an asphalt track in dry conditions. The driver has a mass of 70 kg and is riding in a 2000 kg car with rubber tires.

In this assessment you will be using your knowledge of physics to determine if Porsche's claims are warranted. (Image [Source](#))

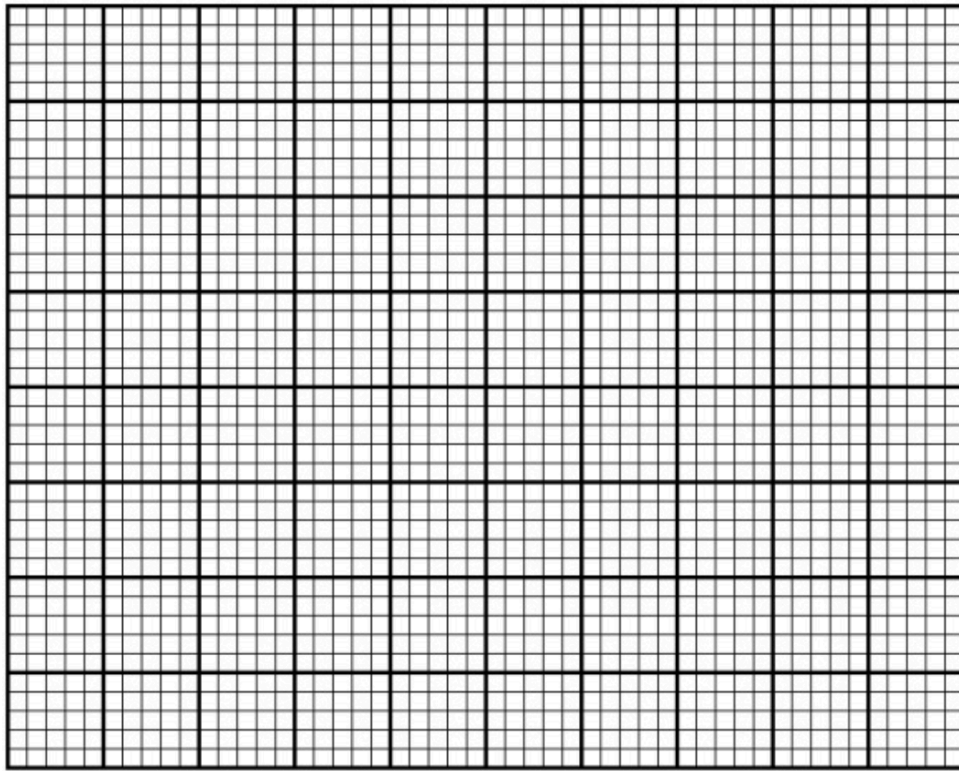
Data collected by Porsche at the track is provided in the table below:

Time (s)	Velocity (m/s)	Distance (m)	Engine RPM	Fuel Pressure (kPa)
0	0	0	0	170.2
0.5	3.8	0.49625	15523	189.7
1.0	8.1	1.98567	15319	194.2
1.5	12.0	4.46625	15674	195.9
2.0	15.9	7.94698	15892	201.3
2.5	19.8	12.40625	15321	200.7
3.0	23.7	17.86573	15783	204.3
3.5	27.8	24.31625	15942	205.1

1. Qualitatively describe any patterns that you see in the data table as time increases.



2. By selecting appropriate data from above, create a graph (either on paper below or in Google sheets) which allows you to determine the average acceleration of the car.



3. Given the information provided, and your answer to question 2, use a free body diagram and written description to model the forces acting on the Taycan that cause changes in its motion.

4. Use the analyzed data as evidence to determine the magnitude of the net force acting on the car.
5. If the driver was removed, and replaced by an autonomous system to drive the car, how would this affect the acceleration of the car given the car will produce the same net force.
6. Using your answer to the questions (1-3) and your knowledge of Newton's Second Law of Motion, determine if the data provided by Porsche is scientifically possible. Support your claim with evidence and reasoning using data & calculations.



7. What specific changes in track conditions could **cause** the car-track **system** to operate differently?

