My Awesome Automobile Design Project

After **visiting** the Cammack Tucker Exhibit at the AACA Museum, and **reading** the pamphlet about automobile systems, **design your own awesome car of the future that includes at least two Tucker innovations from the past,** such as an all-independent suspension or the central cyclops-eye headlight. Then **create at least two or more innovations that are part of the automobile systems you read about and that are important to the future car owner.** Remember innovations are something new or different.

The following websites and hand-out will aid students in choosing their ideas for both past and present innovations: **Use at least 2 or more online websites about automobiles and automobile technology.**

1. Museum website: **aacamuseum.org** click on permanent exhibits to find out more information about Tucker automobiles.

2. Current websites**: caranddriver.com, futurecars.com, motortrend.com, popularmechanics.com** or your choice of website (use the search bar on each site, type future cars or future technology for information).

3. The Automobile Systems hand-out, it is best to read this hand-out entirely before starting the project.

Describe your design project on Twitter at #myawesomeautomobiledesignatAACA, provide a general description of your vehicle and innovations then learn about others' vehicles and creations.

Part I. Answer the following questions below and write in complete sentences.

1. Which two Tucker innovations (from the past) did you choose to include with your automobile design and how were they helpful to their owner in the 1940's? (please write at least two sentences or more for each)

Tucker innovation 1:

_____

This Tucker innovation was helpful to the automobile owner because:

_____
_____
_____
_____
_____
_____

Tucker innovation 2:

_____

This Tucker innovation was helpful to the automobile owner because:

_____
_____
_____
_____
_____
_____

My first future innovation is part of the _____ system in an automobile.

My first future automobile innovation will be helpful to its owner because: (two full sentences)

_____
_____
_____
_____
_____
_____

My **second** future automobile innovation:

_____
_____

My second future innovation is part of the _____ system in an automobile.
My second automobile innovation will be helpful to its owner because: (two full sentences)
_____
_____
_____
_____
_____
_____

2. **Describe the interior features** of your vehicle starting with the base package: including the number of passenger seats, material and color and then a trim package: including the type of navigation systems or other extras.

Passenger Seats: _____ Material and Color of Seats: _____

_____

Trim package features such as: navigation systems, sound systems etc.:
_____
_____
_____

3. **Describe the exterior features** of your vehicle: including dimensions (length, width and height), colors available and outside extra features available such as sunroofs or roof racks. Remember to be creative with your answers.

Dimensions: _____

Extra Features: _____

4**. Describe your type of engine** either an internal combustion, electric, hybrid or other type of engine that runs on alternative fuel. Include the number of cylinders (battery or fuel cell for electric/other vehicle type), the type of transmission and the fuel economy. For an electric vehicle or fuel cell, state how many miles your vehicle can get before it needs to be recharged.

Engine Cylinders or Type of Battery or Fuel Cell: _____

_____

Transmission Type: _____

Fuel Economy: _____

5. List **two prices** for your vehicle: base cost and trim package cost (remember trim package features add cost to the vehicle). Read about the cost of vehicles at https://www.consumer.ftc.gov/.../0209-**buying** to help with this answer.

Base Cost: _____

Trim Package Cost: _____

6. What **type of consumer** would buy your car and why? Example single men, single women, large families etc.

_____

_____

_____

_____

Part III. Citations –a minimum of two web site sources:

Cite your website below in MLA formatting by including the following information from the website: Note the URL address is no longer needed for MLA citations.

Website: Editor, author, or compiler name (if available). *Name of Site* (in Italics). Version number (if available). Name of institution/organization affiliated with the site, (sponsor or publisher if available), date of resource creation (if available). Medium of publication. Date of access.

*Notice the day of the month, then the month and year are written for the date.

**Use n.p. if no publisher name is available and use n.d if no publishing date is given on the site.

Example: Miller, Susan. *Futurecars.com,* deepdivemedia.net, 20 July 2013. Web. 6 October 2015. (there was no version number available for this citation)

For an individual page on a Web site: List the author or alias if known, followed by the information covered above for entire Web sites.

An Article in a Web Magazine: Provide the author name, article name in quotation marks, title of the Web magazine (in italics), publisher name, publication date, medium of publication, and the date of access. Remember to use n.p. if no publisher name is available and n.d. if no publishing date is given.

Example: Goldberg, Stephen. "10 Ways to get better Gas Mileage." *Motor trend*, The Enthusiast Network. 16 Aug. 2012. Web Magazine, 10 May 2016.

Notice the second line of the citation is indented if it is needed (use the hanging indent in Word formatting). **Citations should be listed in alphabetical order.**

Citation 1:

Citation 2:

Citation 3:

Citation 4:

My Awesome Auto Design Rubric

Requirements	4	3	2	1
Written Content on Tucker Innovations and Future Automobile Innovations of Part I	Two Tucker innovations (of the past) are named and explained, two future innovations are named and their benefits to consumers are explained all in complete sentences	Two Tucker innovations (of the past) are named and explained. two future innovations are named and their benefits to consumers are explained but not in complete sentences.	One the two Tucker innovations or future innovations is not listed or one is not explained in sentence form.	One of the Tucker innovations is not explained and one of the future innovations does not explain its benefits to consumers.
Automobile Design Specifications #s 1-6 completed (use your own ideas) Part II	All six specifications are complete: vehicle type, interior, exterior, engine transmission, base, trim cost and type of consumer.	Only five of the six specifications are included and described about the vehicle.	Only four of the six specifications are included and described about the vehicle.	Only three of the six specifications are included and described about the vehicle.
Creativity	The car features are detailed and the future innovations display unique and new ideas about automobiles.	The car features are detailed, but one of the future innovations does not include any new ideas.	The car features are detailed, but the two future innovations do not include any new ideas.	There is not enough detail in the car features and the two future innovations do not include any new ideas.
Correct Citations (giving credit to sources) Part III	Includes **more than two sources** with correct and complete citation information.	Includes **two sources** used with correct and complete citation information.	Includes **only one source** used and/or **has two citation information mistakes.**	Includes **three or more citation information mistakes.**
Mechanics	Grammar, punctuation, spelling and capitalization are all correct.	Includes two to three grammar, punctuation, spelling and capitalization mistakes.	Includes four to five grammar, punctuation, spelling and capitalization mistakes.	Six or more grammar, punctuation, spelling and capitalization mistakes.

Total Score: _____/20 Comments:

Teacher Instructions for My Awesome Automobile Design Project

1. Students will learn to take and use information that they learned about at the AACA museum's Tucker Exhibit and incorporate Tucker innovations from the past into their future car design. Students will also gain an understanding and appreciation into the design features of an automobile, how the designs relate to the consumer market and what is involved in buying an automobile. Teachers must act as a facilitator and guide students with the use of the websites to help them with these answers.

2. This project will require the use of individual computers with Internet connection for students.

3. It is recommended to assign the reading of the Automobile Systems hand-out in class before assigning the project. Teachers should give a quick question and answer time with students on how automobiles are designed, the importance of automobile sub-systems and why automobile design is helpful for their future.

4. Teachers and students can Google images of each subsystem on the Internet in order to view its design and automotive location and the vehicle parts that make up the subsystem. Using Google images can aid students in creating their future innovations and design process.

5. Teachers should review how to cite sources in the Modern Language Association's formatting for websites and online encyclopedias. Next, review the entire Awesome Automobile Design Project with students including the timeline and assign a due date.

6. The ideal time to complete the project is one day for reading the automobile systems hand-out, discussion and introduction of the project. Three more class periods for the actual completion of Parts I, II and III (with time needed at home if students do not complete each of the three parts per one class period) is recommended.

7. Students can follow their classmate's vehicle designs on Twitter at **#myawesomeautomobiledesignatAACA** to learn about others' vehicle designs or innovations. Teachers can provide time for students to use their mobile devices in class or outside of class.

8. This project could also be an interdisciplinary project between technology education and English classes for the sixth through eighth grade.

Common Core Standards for Design Project

Writing for Science and Technological Subjects

CC.3.6.6-8. E. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CC.3.6.6-8. F. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

CC.3.6.6-8. G. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CC.3.6.6-8. H. Draw evidence from informational texts to support analysis reflection, and research.

CC.3.6.6-8. J. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Language Arts

CC.1.2.6-8. B. Cite textual evidence to support analysis of what the text says explicitly, as well as inferences and/or generalizations drawn from the text. E06.B-K.1.1.1, E07.B-K.1.1.1, E08.B-K.1.1.1

CC.1.2.7. F Determine the meaning of words and phrases as they are used in grade-level reading and content, including interpretation of figurative, connotative, and technical meanings. E07.B-V.4.1.1 E07.B-V.4.1.2 E07.B-C.2.1.

CC.1.2.6. G Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

CC.1.2.6. I Examine how two authors present similar information in different types of text. E06.B-C.3.1.2

CC.1.2.7. I Analyze how two or more authors present and interpret facts on the same topic. E07.B-C.3.1.2

CC.1.2.6-8. J Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression. E06.B-V.4.1.1 E06.B-V.4.1.2

CC.1.2.6-8. K Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade-level reading and content, choosing flexibly from a range of strategies and tools. E07.B-V.4.1.1

CC.1.2.6-8. L. Read and comprehend literary nonfiction and informational text on grade level, reading independently and proficiently

CC.1.4.6-8. A. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information clearly.

CC.1.4.6-8. F Demonstrate a grade- appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling. E08. D.1.1.1 E08. D.1.1.2 E08. D.1.1.3 E08. D.1.1.4 E08. D.1.1.5 E08. D.1.1.6 E08. D.1.1.7 E08. D.1.1.8 E08. D.1.1.9 E08. D.1.1.10 E08. D.1.1.11 E08. D.1.2.1 E08. D.1.2.2 E08. D.1.2.3 E08. D.1.2.4 E08. D.1.2.5

CC.1.4.6. I Use clear reasons and relevant evidence to support claims, using credible sources and demonstrating an understanding of the topic. E06. C.1.1.2 E06. E.1.1.2

CC.1.4.6-8. S Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade-level reading standards for literature and literary nonfiction. E08. E.1.1.1 E08. E.1.1.2 E08. E.1.1.3 E08. E.1.1.4 E08. E.1.1.5 E08. E.1.1.6

CC.1.4.6. V Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

Science and Technology Education Standards

The Scope of Technology

3.4.5. A1. Explain how people use tools and techniques to help them do things.

3.4.6. A1. Identify how creative thinking and economic and cultural influences shape technological development.

3.4.7. A1. Explain how technology is closely linked to creativity, which has resulted in innovation and invention.

3.4.8. A1. Analyze the development of technology based on affordability or urgency.

Core Concepts of Technology

3.4.5. A2. Understand that a subsystem is a system that operates as part of a larger system.

3.4.6. A2. Describe how systems thinking involves considering how every part relates to others.

Technology Connections

3.4.7. A3. Explain how knowledge gained from other fields of study has a direct effect on the development of technological products and systems.

Society and Development of Technology

3.4.3. B3. Identify and define products made to meet individual needs versus wants.

3.4.4. B3. Explain why new technologies are developed and old ones are improved in terms of needs and wants.

3.4.7. B3. Describe how invention and innovation lead to changes in society and the creation of new needs and wants.

3.4.8. B3. Explain how throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.

3.4.4. B4. Describe how the history of civilization is linked closely to technological development.

3.4.5. B4. Identify how the way people live and work has changed history in terms of technology.

3.4.6. B4. Demonstrate how new technologies are developed based on people's needs, wants, values, and/or interests.

3.4.7. B4. Explain how many inventions and innovations have evolved by using deliberate and methodical processes of tests and refinements.

3.4.8. B4. Explain how societal and cultural priorities and values are reflected in technological devices Recognize design is a creative process and everyone can design solutions to problems.

3.4.5.C1. Explain how the design process is a purposeful method of planning practical solutions to problems.

3.4.6.C1. Recognize that requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.

3.4.7.C1. Describe how design, as a creative planning process, leads to useful products and systems.

Engineering Design

3.4.3.C2. Explain why the design process requires creativity and consideration of all ideas.

3.4.5.C3. Identify how invention and innovation are creative ways to turn ideas into real things.

3.4.3. D1. Identify people's needs and wants and define some problems that can be solved through the design process.

3.4.4. D1. Investigate how things are made and how they can be improved.

3.4.6. D1. Apply a design process to solve problems beyond the laboratory classroom.

Using and Maintaining Technological Systems

3.4.3. D2. Observe, analyze and document how simple systems work.

3.4.5. D2. Use information provided in manuals, protocols, or by experienced people to see and understand how things work.

3.4.6. D2. Use computers appropriately to access and organize and apply information.

3.4.7. D3. Use data collected to analyze and interpret trends in order to identify the positive or negative effects of a technology.

3.4.8. D3. Interpret and evaluate the accuracy of the information obtained and determine its usefulness

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Automobile Systems

Computer systems control most of the vehicle systems today. Their primary job is to keep emissions low and to notify the driver when something goes wrong with a car part by setting off a "check engine" light. This allows a mechanic to read a diagnostic code and fix the problem with the systems in the vehicle.

The chassis is the framework to which various parts of the automobile are attached. The chassis must be strong enough to hold the weight of the car, and also flexible to withstand the shocks and tension caused by the driving and road conditions. Attached to the chassis are the wheels and steering system, the brakes, the suspension, and the body.

The steering system is for driving and turning the vehicle. The steering wheel is attached to the steering column, which in turn is fitted to an assembly of gears that allow the movement of the steering wheel to be transferred to the front wheels. The assembly of gears is attached to the front axle by tie rods and the axle is connected to the hubs of the wheels.

Wheels are connected to an axle at the front and back of the automobile **and tires** that fit around the wheels are the part of the automobile that come into contact with the road. Tires are generally made of layers of rubber or synthetic rubber around steel fibers that increase the rubber's strength and ability to resist puncture. The correct inflation of the tires improves fuel economy and decreases the wear on the tires.

Brakes provide friction that cause the wheels to stop turning. When the driver steps on the brake pedal, they activate the master cylinder. The force here is transmitted to each wheel cylinder by the hydraulic fluid, the wheel cylinders expand to activate the vehicle's brakes. The car then receives an equal amount of force to evenly slow down the car. Types of brakes include drum brakes, disc brakes and power brakes. Most cars have an anti-lock braking system today.

The suspension system allows the automobile to absorb the bumps and changes in the road surface, keeping the automobile stable. Most cars have an independent front suspension (the two wheels in front are supported separately). In this way, if one wheel hits a bump while the other wheel is in a dip, both wheels will keep contact with the road. This is especially important because steering the automobile is performed with the front wheels. More and more cars also have an independent rear suspension, which improves the handling and smoothness of the ride. The main parts of the suspension system are the springs and shock absorbers. The springs suspend the automobile above the wheels, absorbing the bumps in the road surface. As the chassis bounces on the springs, the shock absorbers act to quiet the movement of the springs.

The body of a car is usually made of steel or aluminum, but fiberglass and plastic are sometimes used as well. While the body forms the passenger area, it also provides storage space, contains some of the automobile's systems, and has other important functions as well. The body can protect passengers from the force of an accident, and a firewall between the engine and the inside of the car protects passengers in the event of a fire. As the car moves, the body's shape helps reduce the level of wind resistance, allowing the driver better handling of the automobile and improving fuel efficiency.

The cooling system keeps the engine cooler in order to run most efficiently and usually uses a liquid-cooled system. The explosion of fuel in the cylinders can produce temperatures as high as 4,000°F (2,204°C); the temperature of exhaust gases, reach to 1,500°F (816°C). Liquid-cooling systems use water (mixed with an antifreeze, which lowers the freezing point and raises the boiling point of water) that moves through a series of jackets attached around the engine. As the solution of water moves through the jackets, it absorbs the heat from the engine. It is then pumped to the **radiator** at the front of the car, which is made of thin metal fins and many small pipes. These allow a large surface area to draw the heat from the water solution. A fan attached to the radiator uses the wind created by the movement of the car to cool the water solution even more. Temperature sensors control the operation of the cooling system, so that the engine stays in the best temperature range.

The electrical system is used for many parts of the car such as the headlights and radio. It includes the ignition switch, ignition coil, battery, starter motor, alternator and distributor. Its main job is working the ignition which is to give the electrical spark needed to ignite the fuel in the cylinders. The initial voltage is supplied by the battery, which is kept charged by the alternator. The ignition switch draws an electrical current from the battery. The starter motor creates the power to carry the engine through the first movements. An electrical current is created by the alternator from the movement of the engine in order to keep a constant supply of energy. The distributor moves the voltage from the ignition coil to the sparkplugs in the right firing order to start the engine.

The engine operates by internal combustion, which is when the fuel is used for power and burned inside of the engine to produce power. Sparkplugs are inside each cylinder of a gasoline-powered internal combustion engine to produce the spark that ignites the mixture of gasoline and air. The **cylinder** is a chamber in which the fuel is ignited and the resulting pressure moves a sliding piston, which turns the engine's crankshaft. The engine goes through four movements-intake, compression, power and exhaust. Engines can have as few as four or as many as twelve cylinders and the diesel engine is different in that it does not have sparkplugs. It relies on the extreme heat of the compressed air to supply ignition.

The exhaust system is a system of pipes that the exhaust comes out from a cylinder through a valve. The exhaust gathers in an exhaust manifold before being moved through the exhaust pipe. Then it travels into the muffler where the exhaust is absorbed in the form of heat, and force which helps to muffle the loud noise. Finally, the gases travel out of the tailpipe and away from the car.

The emission control system in an automobile is linked to the exhaust system, and works in two primary ways. The first is to reduce the levels of unburned fuel. This is done by returning the exhaust to the fuel-air mixture, which is injected into the cylinders to burn as much of the

exhaust as possible. The second method is through a catalytic converter. The catalytic converter is placed before the muffler on the exhaust pipes and contains metals that act as catalysts (which increase the conversion rate of the harmful gases to less harmful forms).

The fuel system stores, cleans, and delivers the fuel to the engine in the right amounts to meet the different needs that arise as one drives. It includes the carburetor or fuel injection system, and fuel tank, fuel lines, fuel pump and air filter. The fuel pump draws the gasoline from the gas tank at the rear of the car, then the carburetor or fuel injection system mixes gasoline with air to produce an explosive gaseous mixture that will move the pistons in the cylinders of the engine. **Fuel economy** in an automobile is how many miles it gets for a gallon of gasoline or diesel fuel.

The oil lubrication system acts to reduce engine wear caused by the friction of metal parts, as well as to carry off heat. At the bottom of the engine is the crankcase, which holds the oil. A pump, powered by the engine, carries oil from the crankcase and through a series of passages and holes to all the many parts of the engine. When the oil flows through the engine, it forms a thin layer between the moving parts, so that they do not touch. The heated oil drains back into the crankcase, where it cools.

The transmission system transmits the energy generated by the engine to the wheels. The gears inside the transmission do the job of bringing down the fast moving input from the crankshaft to the lower rpm's (revolutions per minute) needed by the wheels. There are two types of transmissions. **Automatic transmission** is a transmission that does not depend on the vehicle operator for control. It has a fluid clutch in which the gears change automatically and can produce an unlimited number of torque ratios. Torque is the amount of twisting force the crankshaft has as it spins. **Manual transmission** is a transmission in which the driver controls the shifting of gears and uses a clutch to disconnect the power source. A lever called a stick-shift controls and engages different combination of gears. The driver can change speed and power according to the road or environmental conditions.

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