



Battery Powered Car

Completion time: 5 Lessons

Materials and Resources:

- Sheet foam material
- DC motor, pinion/gear, 9v battery, drinking straws, hot glue gun, soldering iron, lollipop sticks, thin kebab sticks, 4 soda bottle caps for wheels, electrical tape
- Hand or machine saw, hotwire cutter (optional), aluminium tape or foil, sandpaper, sharp knife
- Formech vacuum forming machine
- Suitable plastic material (1.5mm HIPS recommended)
- <https://formech.com/case-studies/formech-visited-build-it-workspace-california-usa>

Skills at a glance:

Mathematics

Measurement, scale, numeracy

Language

Listening skills, following instructions

Thinking Skills

Design, problem solving, engineering basics, expression, research and development, independent thought

Science

Heating plastics and effects, plastic/polymer material knowledge, computer technology, learning around battery powered circuits

Project Outline:

This project is an ideal cross over for students exploring very basic circuits, motors, or simple electronics projects. It requires the construction of a very simple 9v battery powered car mechanism, which can be constructed by whatever means deemed suitable by the teacher or students, although within this project plan there are rough notes provided to get students started. The project's crowning glory will be the perfectly vacuum formed body, hiding away the workings of the battery powered car, and giving it a real individual look fresh from the imagination of the students.

Method:

Before students can begin to imagine what their car will look like, they must first produce the bones of the project, which will be a 4 wheeled battery powered chassis. This will directly influence the dimensions of the car body.

For the chassis, students can get creative and use prior engineering experience, or indeed, online research to design and build their car. It is advised to keep this as simple as possible, although teachers may wish to pursue their own building methods using their own chosen materials. However, here is a list of simple materials which provides everything needed to produce a basic battery powered chassis; DC motor, a pinion/gear, 9v battery, drinking straws, hot glue gun, soldering iron, lollipop sticks, thin kebab sticks, 4 soda bottle caps for wheels, electrical tape.

Having completed the electronics portion of the project, students can now turn their attentions to the car's vacuum formed body work. Measuring the dimensions of the battery powered chassis and noting the position of the wheels, students must use these dimensions to guide and inform their design choices.

For the vacuum formed car body, using sheet foam material as the mould material is recommended due to its ease and speed of working. Layering and gluing together sheets of building insulation foam, and then cutting it to the desired shape will produce a very effective car body mold. This might utilise simple sawing methods, the use of a small sharp knife, or hotwire cutter. Rough edges and sharp corners can be smoothed using fine sandpaper.

Homework Tasks:

Seen as this project requires the production of a battery powered car mechanism, homework provides a great opportunity for students to conduct research and plan the production of this. There are a multitude of online videos which provide tutorials on how to build a car from simple household materials. Students might be tasked with conducting independent research, and developing their very own project plan to use in class for this element of the work taking place in the classroom. This alone will clearly demonstrate the level of a student's existing knowledge, as well as providing them with a whole range of new ideas and techniques.

Optional Extras:

This project develops a very simple car mechanism from accessible and cheap materials. Teachers and students may wish to take this to the next level, by creating a car which is much more hardy and professional, using tougher materials and producing a much higher spec car. For example, using an MDF baseboard to mount wheel axles, the motor and battery, and instead of making a simple vacuum formed casing, students might explore designing a car body much more reminiscent of their favourite car. The core principals and method of this project will remain the same, but see students use a wider range of materials, techniques, and design considerations.

Method: (Continued)

To prepare the foam mold for the vacuum forming process, it must first be covered with aluminium tape, or aluminium kitchen foil to protect it and ensure mould release. Moulds can now be vacuum formed using suitable plastic material, although HIPS is recommended due to its impact strength and range of bright colours. Formed car bodies can now have excess material trimmed off.

The vacuum formed car body can now be mounted on the prepared battery powered chassis, and be driven, raced, and enjoyed around the classroom, with students having learned a great deal about a number of design and engineering techniques.

Student Accomplishments:

- The production of a simple battery powered car
- Knowledge of converting a DC motor into kinetic movement
- Experience problem solving
- Internet research and development
- Being creative with materials presented
- Experience using machine and hand saws
- Practical hands on experience using a vacuum forming machine, and understanding its wider application

Teachers notes:

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