Organizer for Chemistry Cars Final Project

PART 1:

Requirements:

1. Car must fit in shoebox.
2. Must be less than 2 kg total mass (negotiable with your design plans shown)
3. Cannot be constructed from pre-existing kit car or model kit. Must be student design.
4. Building materials are open-ended but must be safe (teachers will provide K-nex building kits)
5. Chemicals, designs and steps should be approved with teacher before proceeding. (Note: $NaHCO_3$ baking soda and CH_3COOH vinegar are NOT allowed as reaction materials.)
6. Car must travel 10 meters in a straight line.
7. Must move by chemically generated power. You will be provided a small electrically powered motor. If there are questions, ask the teacher.

Extra credit options: Up to 10% extra credit if it works:

• A braking device to stop at an exact spot.

• A timing device for controlling chemicals coming in contact with one another.

• Others can be suggested and must be cleared through teacher.

GOALS:

1. Apply basic design and engineering skills to build and modify a car that is propelled by a chemical reaction.
2. Use proper laboratory technique and skills to collect in the design, modification, and completed phases of the car to demonstrate improvement.
3. Work with a group of four as a functioning team in the classroom (and out) to learn the Engineering process of problem solving.
    A. Brainstorm ideas.
    B. Research appropriate and safe chemical reactions and **correctly cite sources**
    C. Correctly perform the reaction in the lab and collect data.
    D. Problem-solve to correct design flaws.
    E. Collect and analyze data to show progress.
    F. Communicate results in a written laboratory report.

PART 2:

Basics:

Before starting the building process, students should write out a complete list of requirements they want to accomplish including size, shape, and all specific goals.
Communicate a list and get it approval by the teacher before going any further. This may be accomplished Via E-mail. **Background research is vital to this project! Use APA citations.**

1. Major design concepts and problems the team will be designing around (attempting to solve).
2. Has it been done before? By whom? When? **Properly cite sources**.
3. What chemical reactions could possibly be used to safely propel the car? **LIST AT LEAST TEN**. Cite who has used them before, where did you get your inspiration? Give the balanced equations and select the reaction you will use and why.
4. Give the quantities (in gram amounts) needed to run each trial you will need.
5. What are the products of your reactions? And what waste/hazards need to be considered for disposal?
6. What are the costs and availability of the materials used, chemicals and building materials can they be reused or recycled?

PART 3:

Design:

The design component should include:

- Scale drawings
- Materials list
- Diagrams
- Cost
- Redesign suggestions
- Car dimensions, including car length, width, height and mass all **using metric measure**
- Discuss the effectiveness of different materials in terms of strength, flexibility, cost, mass, etc. You will be provided some K-Nex building materials for the chassis and wheels. Weights and chemicals can be obtained from the teacher. There are some tools available. You may bring tools and supplies from home and lock then in a lab drawer, but you must approval from the teacher first.

PART 3:

Extras, pictures, and citing your work:

In the space provided below, you may add photos or draw car designs. Write down project ideas and anything extra you want to include. Include citations as needed. CAD drafting programs are encouraged if you have that skill set in your group!

2017-2018 Chemistry Cars Project Time-Line

Nov. 14 or 15th	Introduce Project Organize into groups and choose roles Brainstorm ideas and begin research
Date to be Determined	Mechanical Engineer completes Car Design Proposal by end of period (to be reviewed by group and submitted to "upper management"). Research reactions and design ideas in class. Work on car construction. Car Design Proposal includes • major design components • materials needed • general diagram • other ideas and research directions
Date to be Determined	Chemical Engineer completes Reactions Proposal by the beginning of period (submitted to "upper management"). Reactions Proposal includes: • 10 balanced chemical reactions to be tested • materials list (including quantities and relevant calculations) • plan to test reactions • Environmentally safe student made batteries are encouraged! Test chemical reactions in class and gather relevant data.
Date to be Determined	Design Engineer completes Car Design Progress Report by the beginning of period (submitted to "upper management"). Car Design Progress Report includes • general explanation of reaction test results • reaction choice and rationale • more specific design details and diagrams Work on car construction and make any adjustments needed.
Jan. 18th, 2018	RACE DAY – Car must travel 10 meters in a straight line by this day (inclusive) Project Manager submits Final Report (with input from all members of the group). Final Report includes • background research (reactions, materials, waste, cost, etc.) • car design details (diagrams, dimensions, pictures, etc.) • data and results – may include video or photographic evidence (reactions tested, velocities, distances, mass carried, progression of improvement of car design, etc.)

- reflective essay on the process (problem, materials, design procedure, details of problems encountered and corrections or modifications made, conclusions and future redesign ideas)

Engineering Project Responsibilities

1. Project Manager:

Project manager organizes and plans access to materials and communicates with team members and "upper management" (the teacher). Project manager must also review all progress reports and ensure that the project is moving forward in a timely way. Project manager has the ultimate responsibility of decision-making. Project manager helps with building and testing, and makes sure that all components of the final report are complete. Background research and APA citation are ultimately the project manager's responsibility. Project manager stores car as work is being completed, coordinates workload responsibilities, and records who does what. Finally, the project manager is responsible for making sure that the ideas of all members of the group are heard and considered.

2. Design Engineer:

Draw scale diagrams using ruler and metrics or construct (using CAD or similar software) plans for building the car. The design engineer assists in building, keeps track of modifications, and updates plans as necessary. Design engineer may build prototype. Design engineer also assists with the background research and citations.

3. Mechanical Engineer:

Mechanical engineer is responsible for physically building the car, including supplying tools to construct chassis drive train and attaching fuel source. Mechanical engineer obtains materials and tools from group members, parents, and the teacher. Mechanical engineer predicts results and decides on parameters to improve.

4. Chemical Engineer:

Chemical engineer makes decisions pertaining to what reactions will be run and does background research into what chemicals and reactions will used to run the car. Chemical engineer obtains the

needed chemicals from the teacher to test-run reactions (MUST BE DONE AT WHS!!!). Chemical engineer records and explains what reactions are used, providing APA citations. Chemical engineer makes decisions as to which reaction to choose to ultimately power the car. It must be SAFE!