Balloon Car Challenge

Build a balloon-powered car that will travel 1 meter.

Materials:

- Power: Balloon
- Car Body: Recycled materials such as plastic bottle, plastic cup, cardboard, index card, etc.
- Wheels: CDs, bottle caps, hard lifesaver candies, etc.
- Axles: Straws, wooden pencils, skewers, etc.
- Other materials: plastic straws, glue, tape, paper clips, scissors, rubber bands.

Engineering Design Constraints:

- The car must be propelled forward by the air escaping the balloon.
- The car must be stable and not fall apart when in use.
- The car must travel at least one meter.
- The car must travel in approximately a straight line.

Math Connection:

Calculate the average (mean) speed of your balloon car. The equation for this is:

$$\text{Average speed} = \frac{\text{Total distance}}{\text{time}}$$

Measure the total distance traveled in centimeters and divide by the total time in seconds.

What is your average speed? _____ cm/second

Convert to cm to meter per second: _____m/second

Engineering Design Process

(You will be working with a partner)

Names: Per. _____

_____

_____

Identify the Goal:

After reading the Challenge Sheet, describe the goal of the challenge in your own words. Include any important design considerations.

Materials: The balloon, tape and rubber bands will be provided by your teacher.

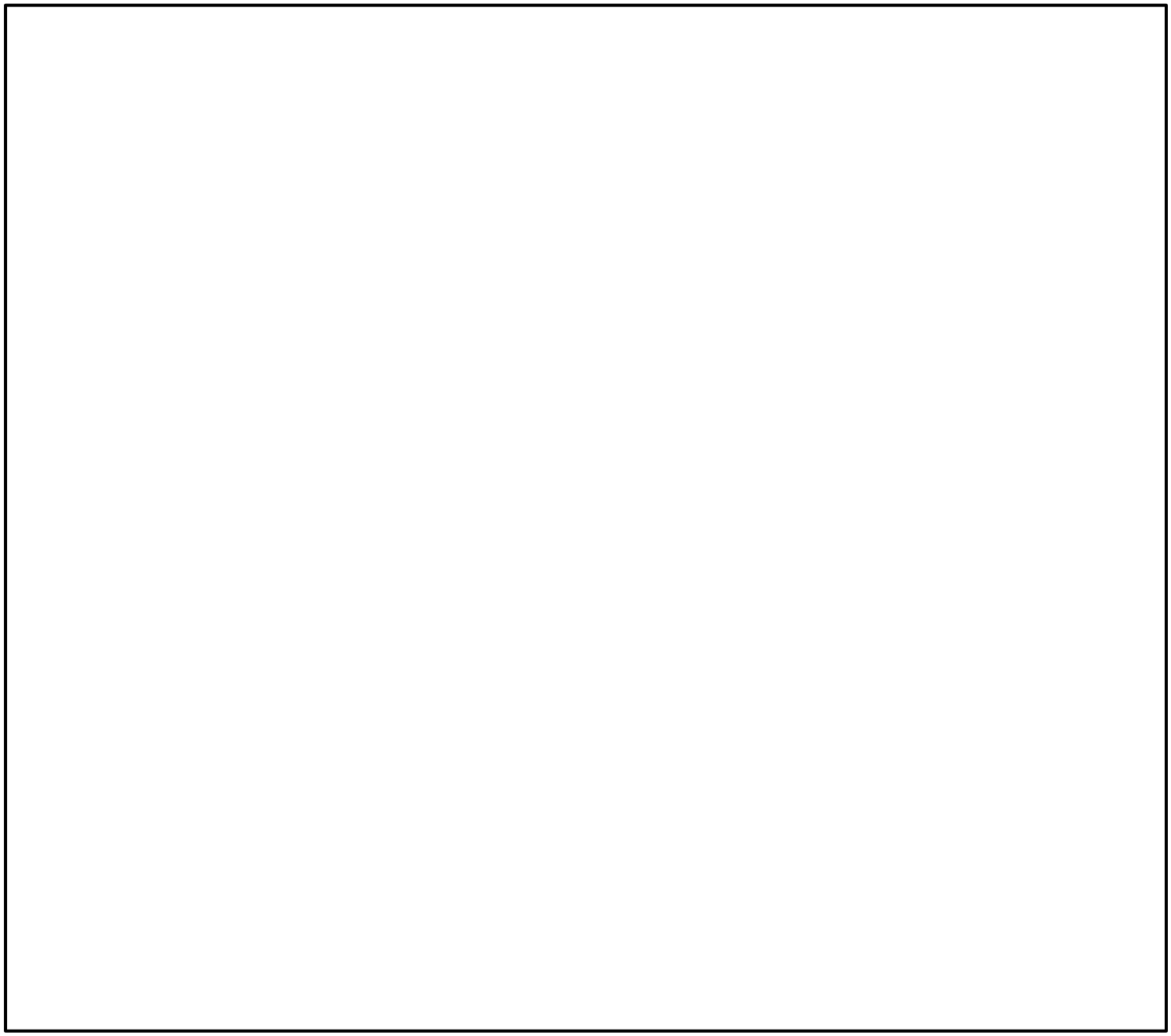
Body: _____

Wheels: _____

Axels: _____

Brainstorm: Review your materials list. The engineering design constraints may require specific materials to be used for the design.

Design: How will you solve the challenge? Sketch at least one design idea and label the parts of the design along with the materials used.



Build: Using your design sketch, build your solution. Keep in mind that materials may not work as you predicted. Do not make modifications yet.

Test & Evaluate: Test your design and record results below. Remember that failure is an important part of the engineering process! After each trial, review the results and make changes to improve your design.

a) Important: for sanitary reasons, designate one person from your group to inflate the balloon.
b) Inflate the balloon by blowing through the straw.
c) Quickly press your finger over the tip of the straw.
d) Place the car on the table at the "0" mark on the tape measure.
e) Release your finger and watch the car until it comes to a stop.
f) Record how far the car traveled in the data table.
g) Note any problems with your car. For example, do the wheels wobble? Does it drift off to one side?

Trial	Results of Trial Speed = m/s	Observation Notes
1		
2		
3		
4		
5		
6		

Math Connection: Mean (Average) Speed

Directions—What is your mean speed?

Mean distance = _____.

My final answer is _____.

Did you include the correct units in your answers? Did you round your answers to the correct number of decimal places?

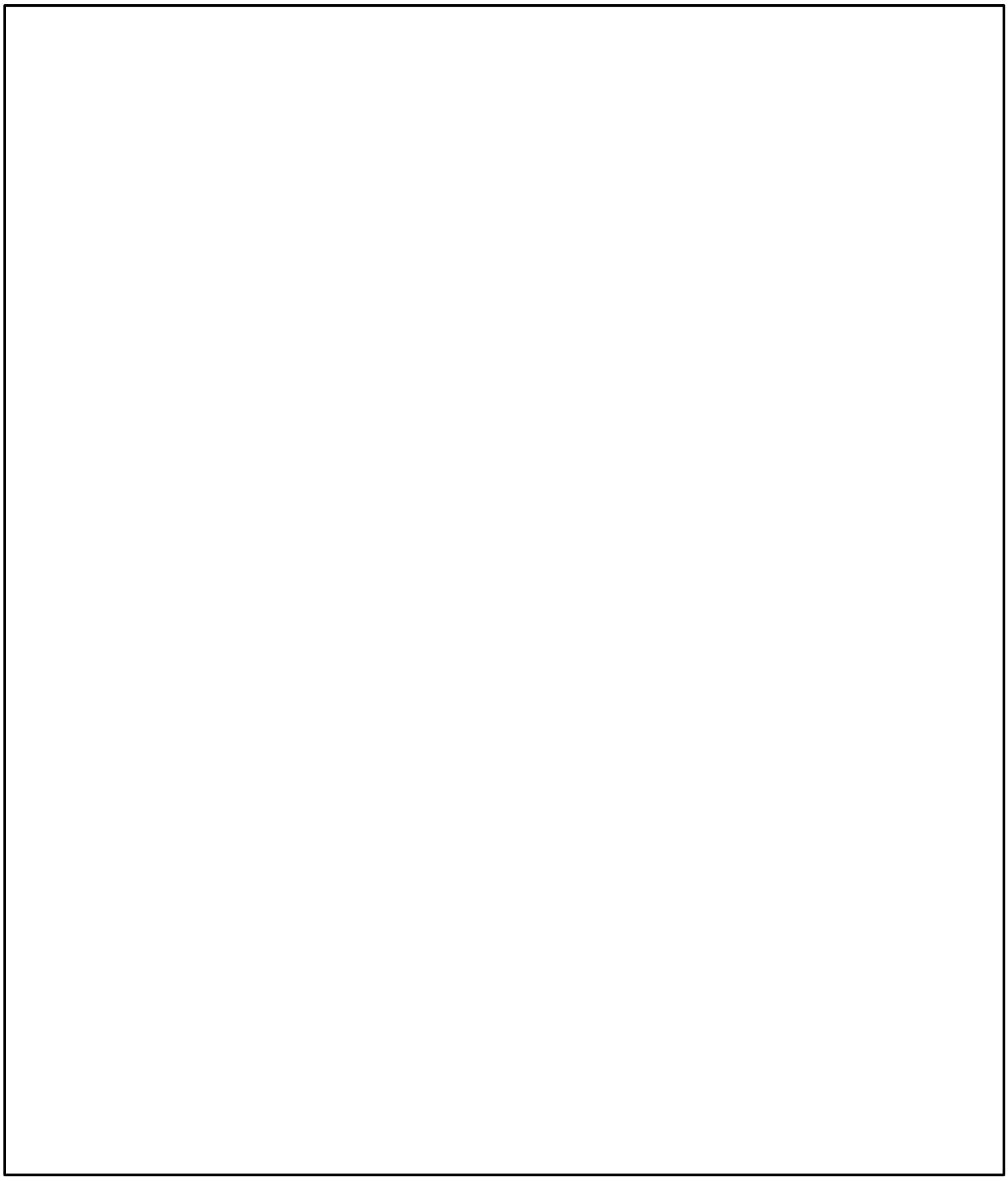
Refection (Ideas for Improvement):

a. How well did your design work compared to other groups?

b. What parts of your design worked well?

c. What parts of your design could you improve? Which variable would you change?

Solution: Sketch your final design and label the changes to materials/design. Identify which variable you are changing.



Reflect and Share: Answer the following question then race your final design with another team. What challenges did you face during the design process? List at least FIVE challenges you overcame.

Other Teams:

Team Name	Results of Trial (Who won)	What is different between the two designs?
1	Them/Us	
2	Them/Us	
3	Them/Us	

POV (Point of View)—Critical Thinking Question

Use 3-5 Complete sentences to answer: Why is it important to test a design in an engineering project?

Materials—Review the rubric. You must use the materials appropriately.

Items	Qty	Received	Returned
Straws	3		
Wheels	4		
Index Card	1		
Balloon	1		
Rubber band	1		

Failure to return all items will result in a lower grade.

Engineering Rubric: Each day you will be graded by the below rubric.

Day One	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Defining the Problem—Students can identify the teams/partnership's goal for completing the design/prototype.	There is no evidence that the student can identify the problem.	Student needs help to answer the questions: What is the problem or need? Who has the problem or need? Why is it important to solve? .	Student can identify and answer all the questions from Score 2.	Along with 3, student actively looks for and suggests ways to identify the goal to help support team-mates struggling with identifying the problem or answering the questions.

Day Two	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Brainstorming—Students work as a team/partnership to brainstorm/mind map several designs.	There is no evidence the brainstorm handout is complete.	Student needs help to put their ideas down onto paper.	Student completed a mind map.	Pre-planning may include several ideas that were well thought out and ingenuity.

Day Three	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Build—Students build a model/prototype of the selected design.	There is no evidence the assigned team task is complete for the team prototype.	Student cannot complete assigned task for team prototype on time.	Student can complete assigned task on time.	Along with 3, student actively looks for and suggests ways to help support team-mates struggling

				with completing their assigned task.
Day Three	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Observation (Test and Evaluation)— Students test and evaluate the built model/prototype and observe how it works to improve the design.	There is no evidence the observation data sheet is complete.	Student needs help in putting a solution to the prototype down on paper.	Along with Score 2, there is at least one suggestion for improvement to the prototype.	Along with 3, student may actively suggests multiple solutions and ways to improve the prototype.

Day Four	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Redesign— Students make modifications to the existing design to improve the design.	There is no evidence the student assisted in fixing a problem with the prototype.	Student needed help to fix the prototype.	Student can fix the prototype.	Along with 3, student may actively look for and suggest multiple ways to fix the prototype.

Day Four	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Test Final Project for Success— **I**mprove the design until the is success.	There is no evidence the student re-tested the prototype.	The student needs help in re-testing the prototype and completing the observation data sheet.	Student can test and complete data sheet for re-testing the prototype.	Along with 3, student may actively look for ways to support other team-mates re-testing the prototype.

Day Five	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Reflection and Share	There is no evidence the reflection sheet is complete.	The reflection sheet lists less than five challenges. The list is in bulleted form.	Reflection sheet is complete using complete sentences and provides an example for each five challenges.	Along with Score 3, student may provide ways to use the design outside the classroom.

Student Safety Rubric

Every Day	1 No Evidence	2 Approaching Proficiency	3 Proficient	4 Advanced
Safety	No evidence safety procedures were followed.	Most of the time, safety procedures are followed with being re-directed only once or twice.	All safety procedures are followed.	Student may provide ways to encourage others to follow safe procedures.
Materials	No evidence materials are used as intended.	Most materials used as intended and returned intact.	All materials used as intended and returned intact.	Student may provide ways to encourage others to use materials as intended and find ways to ensure materials are kept intact.
Following Instructions	No evidence instructions were followed as instructed	Most of the instructions were followed as instructed with needing redirection only one or two times.	All instructions followed.	Student find ways to improve the instructions. Adding additional ways to show higher levels of rigor.