



# 6th Grade STEM



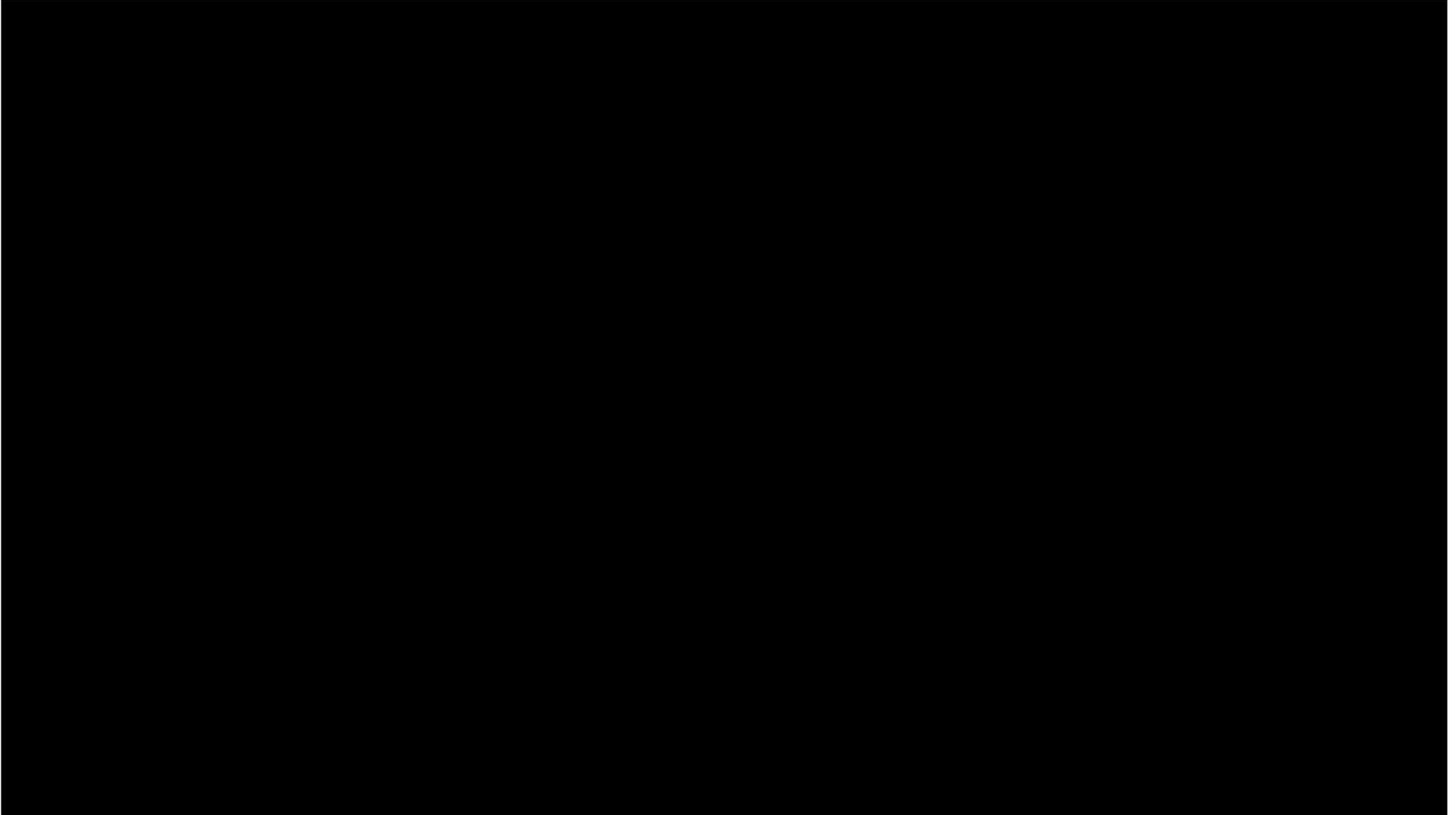
# ENGINEERING DESIGN PROCESS



# Ask

- STEP 1: Identify the Problem - Students should state the challenge problem in their own words. Example: How can I design a \_\_\_\_\_ that will \_\_\_\_\_?

# Ask



If the video doesn't work, access the videos and open them separately.

# Imagine

- STEP 2: Identify Criteria and Constraints - Students should specify the design requirements (**criteria**).

Example: Our growth chamber must have a growing surface of 10 square feet and have a delivery volume of 3 cubic feet or less.

-Students should list the limits on the design due to available resources and the environment (**constraints**).

Example: Our growth chamber must be accessible to astronauts without the need for leaving the spacecraft.

# Imagine



# Plan

- STEP 3: Brainstorm Possible Solutions - Each student in the group should sketch his or her own ideas as the group discusses ways to solve the problem. Labels and arrows should be included to identify parts and how they might move. These drawings should be quick and brief.

# Plan



# Create

- STEP 4: Generate Ideas
  - In this step, each student should develop two or three ideas more thoroughly. Students should create new drawings that are orthographic projections (multiple views showing the top, front and one side) and isometric drawings (three-dimensional depiction).
  - These are to be drawn neatly, using rulers to draw straight lines and to make parts proportional. Parts and measurements should be labeled clearly.

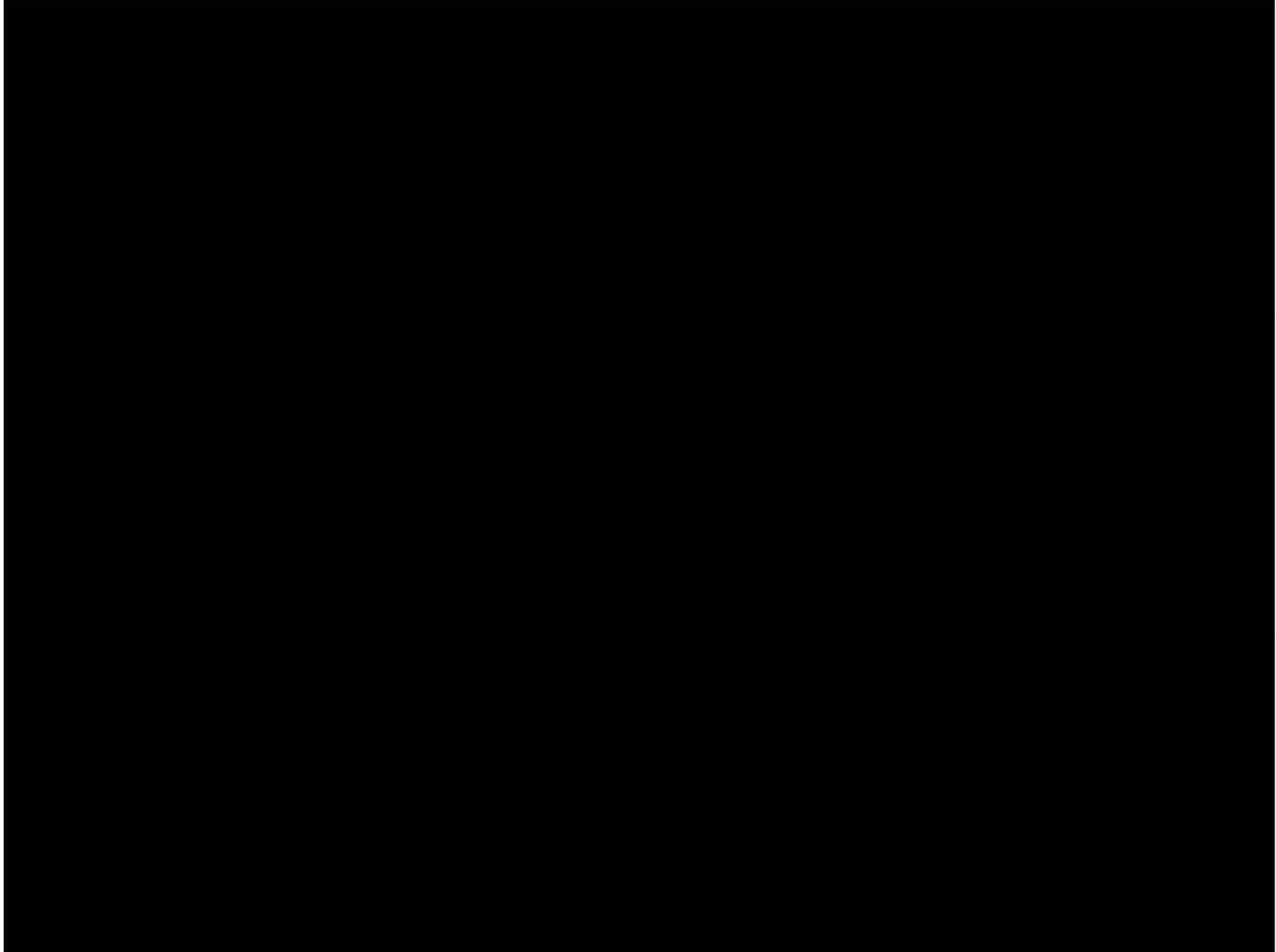
# Create



# Experiment

- STEP 5: Explore Possibilities
  - The developed ideas should be shared and discussed among the team members. Students should record pros and cons of each design idea directly on the paper next to the drawings.
  - Select an Approach - Students should work in teams and identify the design that appears to solve the problem the best. Students should write a statement that describes why they chose the solution. This should include some reference to the criteria and constraints identified above.

# Experiment



# Improve

- STEP 6: Refine the Design
  - Students will examine and evaluate their prototypes or designs based on the criteria and constraints.
  - Groups may enlist students from other groups to review the solution and help identify changes that need to be made.
  - Based on criteria and constraints, teams must identify any problems and proposed solutions.

# Improve



# Projects

- Build a Satellite to Orbit the Moon
- Launch Your Satellite
- Prepare for a Mission
- Design a Lunar Buggy
- Design a Landing Pod
- Design a Crew Exploration Vehicle (CEV)
- Launch Your CEV
- Design a Lunar Thermos
- Build a Solar Oven

# Ground Rules

- Respect your team members
- Listen to all inputs/ideas
- Have an open and free discussion
- Everyone makes his/her best effort

# Schedule

- 9 March: Introduction
  - Set up and group discussion
  - Assign to a team & project
- 10 to 13 Mar: Begin Engineering Process
  - Ask
- 17 Mar to 28 Apr: Working on STEM assignment
  - Twice a week for 2 period per day
- 29 Apr: STEMposium
  - 8:15 AM -1:45 PM
  - 30 Apr will be a backup day as necessary

# Example “Notes”

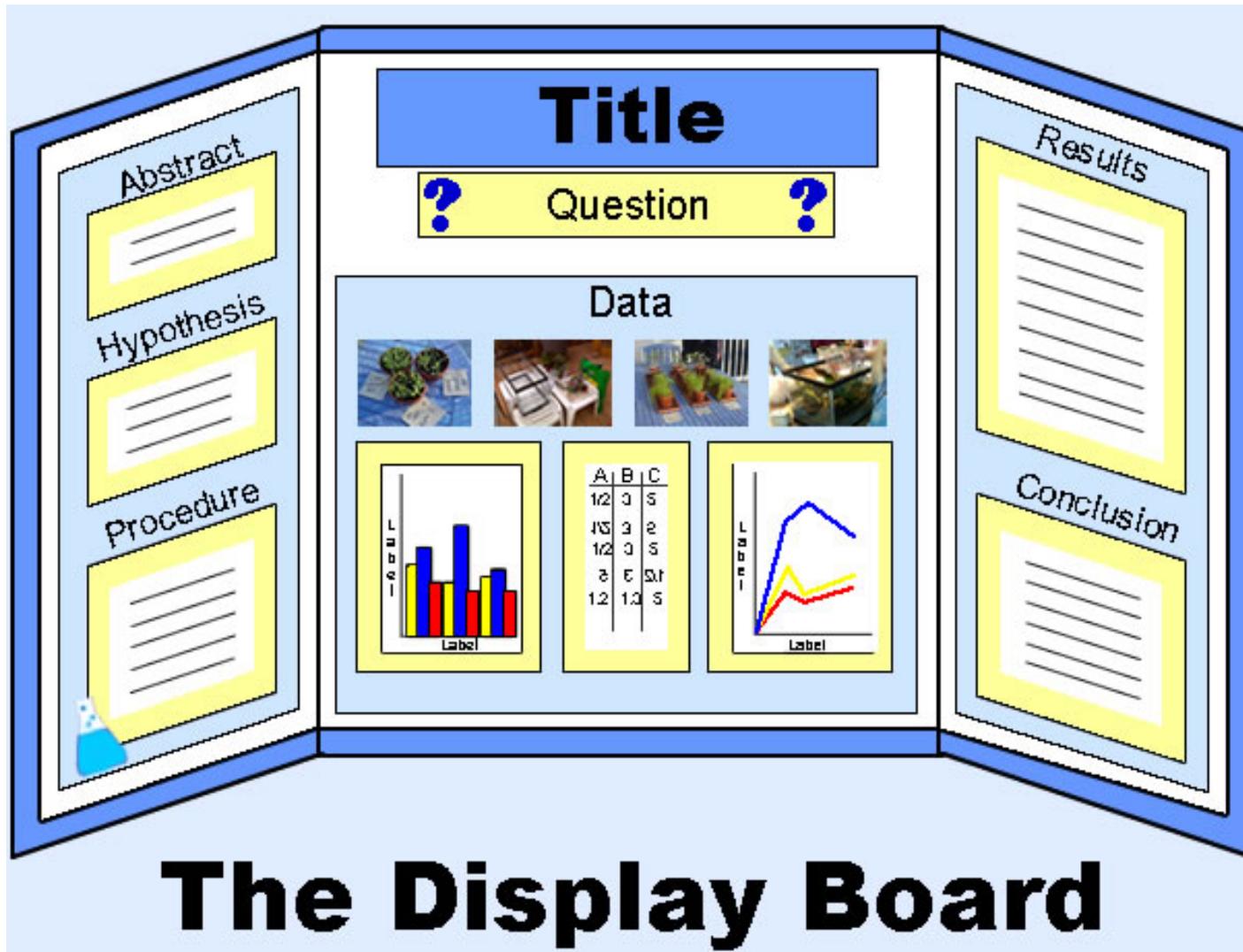
- List your specific task
- Identify or state how you will accomplish the task (be specific). This is your plan.
- Turn your solution around and think of potential problem that it may encounter
- State what you will do to solve/prevent the problem

# Requirements

Using Engineering Design Process;

- Each team will complete a project
- Produce a technical paper
- Create a tri-fold to present your Engineering Design Process by phase

# Example Tri-Fold



## The Display Board



# Technical Paper

## Section One:

-Introduction – Identify members and roles of our team, the name of the project you are working on, and provide a short description of your mission. (This portion should tell us what it is and what it will do!)

-Section Two: Production – Describes the steps to ask, imagine, plan, create, experiment, and improve your product.

1) Ask: Discuss how you should first approach the design problem. Ask the types of questions that engineers would ask. Create a list to be used in the next step.

2) Imagine: This is where you look at the questions you asked and select the ones that are realistic enough for you to accomplish. Then, brainstorm each selection and try to use it to solve your design need/problem.

3) Plan: In this step, you need to create a rough sketch that outlines your solution to your design need/problem. Using your sketch as a guide, you will need to lay out a detailed plan on how you will assemble your product.

- 4) Create: This is where you begin the process of creating your product. Outline the steps you took, including any design changes, in creating your product that implements a solution to your mission need/problem.
- 5) Experiment: Once assembly is complete, you will record your testing process of the design to determine whether it is successful/unsuccessful.
- 6) Improve: This is the final step in the process in which the cyclical nature of engineering process (the six steps in a constant loop) allows the design to be revised based on the results of the experiment stage.
- Section Three
- Design Analysis – Go back and review section two and discuss the challenges your design faced. Explain your reasoning for any changes/redesigns to your original plan. Talk about what worked design-wise and what didn't? Look at opportunities for further improvement; in other words, go beyond what you have created and discuss what else you could do.
- Section Four
- Project Sketch: Provide a detailed sketch of your project design.
- Section Five
- Conclusion – This is where you provide the project summary. Look back and reflect on the process; what did you learn from this?