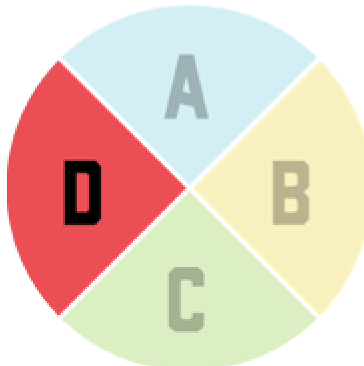
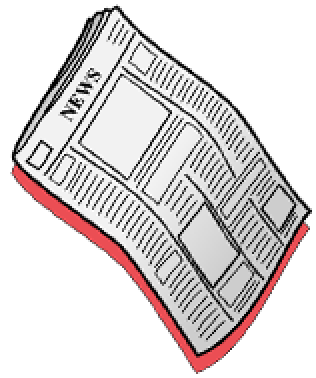
Design Cycle Introduction - Water Tank

Criterion D - Test and Evaluate

Students evaluate the solution against the design specifications to determine its successfulness.





Tank Resources
Actual Water Tanks | Tank Sketches, Paper Tanks & Data | Newspaper Tank Test (3:43)

D.0 - Your Team's Tank

Describe your newspaper water tank.

D.0.1 - Team Tank Name What is the name of your team's tank?

D.0.2 - Team Tank Photos Insert three photographs (one per row) from various perspectives to best communicate your team's tank characteristics. You can reuse images from Criterion C.

D.1 - Design Detailed and Relevant Testing Methods

Design detailed and relevant testing methods that generate data to measure the success of the solution.

D.1.1 - Pre-test - Tank Mass What is the total mass of your team's tank? Write the amount to the nearest tenth of a gram (g).

D.1.2 - Pre-test - Tank Capacity Estimate
How much water will your team's tank hold for three minutes (use milliliters, mL)? Explain your hypothesis in one to three sentences.

D.1.3 - Tank Test Setup and Data Gathering
Video the process of testing your team's water tank. Two group members' laptops will video the testing process from opposite sides of the tank to capture as much data as possible. Insert two links below (one for each video). Document each video's time length as well.

Get Help:
Create a Video with Photobooth and upload the video to Google Drive (1:36)
Set the video share settings to anyone with the link can view.
Video Processing: If you get this error, wait five to ten minutes and try again to access the link.

Tank Testing - Video Links	Video Time Lengths

D.1.4 - Post Test - Amount of Water Held
How much water did your team's tank hold? Answer in milliliters (mL).

D.1.5 - Post Test - Tank Efficiency
How much water did your team's tank hold per gram of material used? That is, divide the amount of water removed (see D.1.4) by the tank's mass (see D.1.1). Your answer is in mL/gram. This is your team's tank efficiency score.

D.1.6 - Post Test - Observations of Other Tanks
In each row, insert a photograph of your most helpful observation notes from the tests of at least four other groups. Helpful notes would contain information to improve your team's tank efficiency score if you rebuilt and retested.

D.2 - Evaluate the Success of the Solution

Critically evaluate the success of the solution against the design specifications.

D.2.1 - Analysis of Team Tank Against the Design Specifications

Compare the design specifications in your *Criterion B - Developing Ideas* document (see Section B.2.1) with the actual tank that your team built. Paste your specifications from B.2.1 below first. Determine the success of your team's tank in terms of each design specification using the following terms:

Exact - Your team's tank exactly met the design specification.
Close - Your team's tank mostly met the design specification.
Middle - Your team's tank met some of the design specification.
Far - Your team's tank met none or very little of the design specification.
NA - You are not sure how your team's tank met the design specification (try to avoid using this).

Design Specification Category from B.2.1	**Design Category Description/Question** from B.2.1	**Design Requirement** Paste your design specifications from B.2.1 here.	**Design Specification: Evaluate!** Only write: Exact, Close, Middle, Far, or NA
B.2.1.1 Shape	What shall be the primary shape of the water tank? Cone, cylinder, cuboid, other?		
B.2.1.2 Size (maximum height)	What shall be the maximum height of the tank? Use centimeters.		
B.2.1.3 Size (maximum width/diameter)	What shall be the maximum width/diameter of the tank? Use centimeters.		
B.2.1.4 Mass	What shall be the specific mass of the tank? Note: The average tank mass in 2017 from 35+ tanks was about 13.8 grams out of a maximum of 18 grams).		
B.2.1.5 Resources - Materials (newspaper)	How much newspaper shall be used to make the tank? Specify the height and width in cm. Note: The maximum amount of newspaper is one sheet that measures 57.5 cm high and 44 cm		

	wide.		
B.2.1.6 Resources - Materials (masking tape)	How much masking tape shall be used to make the tank? Use centimeters. Note: The maximum amount of masking tape is 80 cm.		
B.2.1.7 Resources - Materials (popsicle sticks)	How many popsicle sticks shall be used to make the tank? Note: The maximum number of popsicle sticks is four.		
B.2.1.8 Resources (Tools)	What tools shall be used to build the tank?		
B.2.1.9 Function (General Purpose)	What shall the solution do? What goal shall the tank fulfill?	The newspaper tank shall be built from a minimum amount of masking tape, popsicle sticks, and newspaper to hold as much of the 200 mL of water as possible for three minutes.	
B.2.1.10 Function (Efficiency)	How shall the tank show functional efficiency? How shall success be measured?	The tank shall show functional efficiency by scoring higher than 9.62 mL/gram on the 3:00-minute test. (Note: Scores are based on the amount of water removed divided by the tank's mass. The number 9.62 mL/gram is the average from the October 2017 tests).	
B.2.1.11 Function (Water Removal)	How shall the tank be designed to allow the maximum amount of water to be removed? Note: The tank shall not be squeezed like a sponge to remove water upon completing the test.	The water removal design feature (e.g., spout or nozzle) shall be obvious, located along the top edge of the tank, and not leak upon removal of the water from the tank. The tank shall not be modified (cut or torn, etc.) at the end of the test to remove the water.	
B.2.1.12 Cost	What shall be the cost of the materials?	The large construction company shall pay for the training materials (newspaper, tape, and popsicle sticks). These are the material costs.	
B.2.1.13 Customer /Audience	Who shall be the target audience?	The target audience shall be your supervisor at the large construction company.	

B.2.1.14 Storage	How shall the tank be stored before testing?	The completed newspaper water tank shall be stored for a few days to a week before testing. It shall be stored in a cabinet or other place where it will not be damaged before testing.	
B.2.1.15 Maintenance	Shall the product be maintained for any period of time prior to testing? If so, what needs to be considered?	The product shall not need to be maintained prior to testing.	
B.2.1.16 Safety and Environmental Considerations (while building)	What safety factors shall be incorporated into building the tank?		
B.2.1.17 Safety and Environmental Considerations (while testing)	What safety factors shall be included while the tank is being tested?	Any spilled water shall be wiped up and dried immediately to prevent anyone from slipping and hurting themselves.	
B.2.1.18 Safety and Environmental Considerations (post-testing)	How shall the resources (e.g., scissors, newspaper, water, etc.) be managed once the test is complete? Storage? Disposal? Recycle?		

D.2.2 - Most Accurate Design Specification Which design specification was your team's tank closest to? Explain why in two to four sentences.
D.2.3 - Least Accurate Design Specification Which design specification was your team's tank farthest from? Explain why in two to four sentences.

D.2.4 - Analysis of the Results of the Test
Review your team’s test videos, your observer notes, data from previous years, and reference the goal in the GRASPS. Then use the M.E.A.L. plan to organize your answer for one of these questions:

- Why was your team's tank a design success?
- Why was your team's tank a design failure?
- Why was your team's tank both a design success and a design failure?

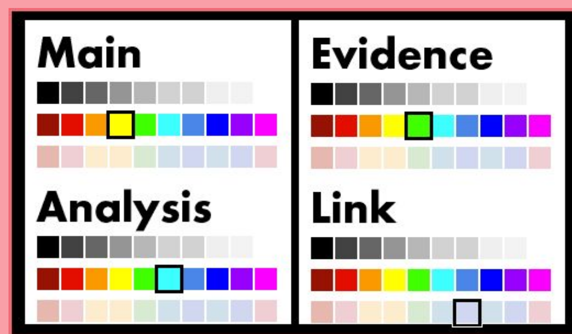
Use specific vocabulary and highlight each part of your paragraph according to these colors:

Main Idea - state your claim that addresses the question

Evidence - provide facts to support your claim (data, primary research)

Analysis - explain the evidence to support your claim (interpretation of data, secondary research)

Link- connect back to the main idea in a new or creative way



D.3 - Explain How the Solution Could be Improved

State how the identified weaknesses and limitations of the solution could be improved.

D.3.1 - Next Estimate
If you were to repeat the process of creating and testing a newspaper water tank with the same resources and goal according to the GRASPS, how much water would this new tank hold (in mL)? Write a number from 0 to 200 mL.

D.3.2 - Next Tank - The Build
What would you do differently in your team's tank construction to better meet the goal in the GRASPS? Explain in two to five sentences.

D.3.3 - Next Tank - The Test
What would you do differently in your team’s tank testing to better meet the goal in the GRASPS? Explain in two to five sentences.

D.4 - Explain the Impact of the Solution

Students consider the impact of the solution on the client or target audience.

Remember your role in the GRASPS. What would your supervisor say to you based on how well you addressed the problem, researched and developed ideas, decided on a solution, gathered data while testing your tank, and reflected on your learning? Explain in four to seven sentences.