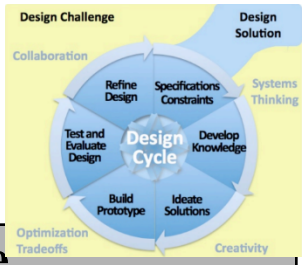
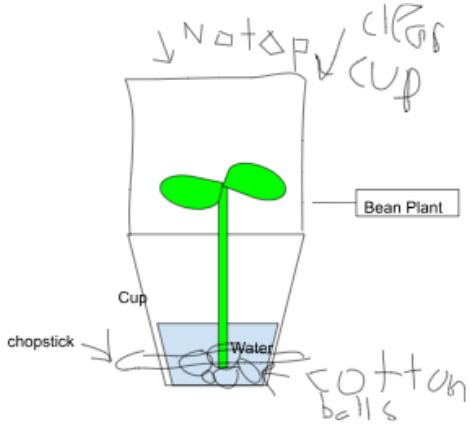
Term 3 Science Practice:

Engineering Design

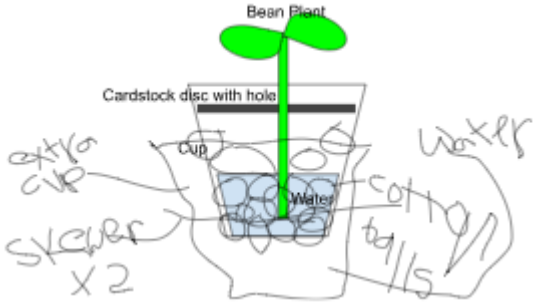


Design Step	Sample Hydroponics Challenge
Identify Problems and Challenge (Specifications / Constraints)	In this challenge, what is the problem that you need to solve? *We need to find a way to grow plants without soil and just having water.* Why might people need to grow plants without soil? *Soil is good for the plants to sit in and grow easier vs just water will be harder to get all the nutrients but soil is expensive.* What are specifications and constraints for this challenge? *Specifications are you cannot use soil and grow the plant in a cup with water and other material. Constraints are limited time and supplies.*
Develop Knowledge	Why do plants grow in soil even though they do not use soil for food? *Plants grow in the ground because it holds them up from falling down.* What role does soil play in plant growth? *Soil gives the plants a good space to grow and provide a small amount of nutrients.* What are the two essentials of a watering system? *Two essentials to a watering system are water and something that is using water.* Why do some plants climb? *Some plants climb because they need to grow upwards to get more light or they will die.* How you want to design your final hydroponic system? *I like the first example for my watering system but I want to add some support for the plant as it grows up.*

Explore Ideas (Ideate Solutions)



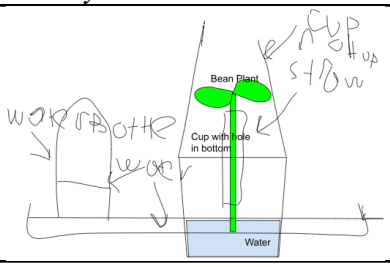
Build Prototype



Input for final design: *I think the plant needs a stabilizer as it grows and we should do the example of one watering system for its water.*

Test and Evaluate Design

Proto-type #	Height (in cm) and Health (1-4 scale from above) of Bean Plants													
	Date: 2/24/23		Date: 2/28/23		Date: 3/3/23		Date: 3/9/23		Date: 3/10/23		Date: 3/13/23		Date: 3/14/23	
	Height (cm)	Health (1-4)	Height (cm)	Health (1-4)	Height (cm)	Health (1-4)	Height (cm)	Health (1-4)	Height (cm)	Health (1-4)	Height (cm)	Health (1-4)	Height (cm)	Health (1-4)
1	30	4	30	3	31	4	32	3.5	33	3.5	33	4	35	4
2	26	2	26	3	31	4	28	3.5	28	3	29	3	30	3.5
3	37	2	36	2	31	2	35	1	29	1	25	0.5	27	0

Test and Evaluate Design (Continued)	How successful were your prototypes? *Prototype 1 was the best prototype of the three. On the first day we measured the prototype at 30 cm and by the last day it was 35 cm and still in great condition. Prototype 2 did grow but did not do amazing. On the first day that we measured it the plant was 26 cm and on the last day we measured the plant it was 30 cm and in pretty good condition. Prototype 3 was the worst prototype of the three. On the first day we tested the plant was 37 cm tall and by the end of the days it was at 27 cm and dead.*
Refine Design	Input for final design: *I think the plant needs a stabilizer as it grows and we should do the example of one watering system for its water.* 

IDENTIFY PROBLEMS AND CHALLENGE: Why hydroponics, define problem/constraints

All 3 responses thorough and thoughtful	Why hydroponics, define problem and define constraints	2 of 3 responses complete and accurate	1 response complete and accurate	No evidence
4	**3**	**2**	**1**	**0**

DEVELOP KNOWLEDGE: WISE Unit, substrates, watering system, and climbing research

WISE unit complete and all 4 answers here are accurate	Correct substrates, watering system, & climbing answers	2 of 3 responses complete and accurate	1 response complete and accurate	No evidence
4	**3**	**2**	**1**	**0**

EXPLORE IDEAS (IDEATE SOLUTIONS): Labeled diagram

Drawing complete and labeled	Drawing complete	Drawing partially complete	Drawing just started	No evidence
4	**3**	**2**	**1**	**0**

BUILD PROTOTYPE: Prototype built based on a labeled diagram

Drawing complete and labeled	Drawing complete	Drawing partially complete	Drawing just started	No evidence
4	**3**	**2**	**1**	**0**

TEST AND EVALUATE DESIGN: Data tables complete and thorough data analysis

Data tables complete and very thorough analyses	Data tables complete and analysis strong	Data tables missing 1-3 entries and analysis present	Data tables missing 4+ entries and analysis lacking	No evidence
4	**3**	**2**	**1**	**0**

REFINE DESIGN: Thorough and thoughtful input and detailed design

Thorough and thoughtful input and detailed design	Relevant input and labeled final design	Input loosely related or final design not labeled	Input not relevant or final design missing key parts	No evidence

4	3	2	1	0