STEM 101
Powered by THE STEM ACADEMY

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TOP THIS

UNIT: STRUCTURES – ACTIVITY 1

THE PROBLEM:

Use the Design Process to explore and test different shapes as building structures. Apply what you discover to build a tower that will support the most weight possible, using only index cards.

CONSTRAINTS AND CRITERIA:

1. Complete the first two challenge rounds as directed to gather information.
2. Include a sketch and summary of your ideas, attempts, and results from each round.
3. Use what you learn to design a tower for the final competition round.
4. The final tower must have at least 3 levels/layers.
5. The final tower must be at least 9 inches tall.
6. The final tower must be made of 20 or less cards.
7. Cards may not be ripped or cut.

MATERIALS: (per 2 person team)

- 3 x 5-inch index cards (approximately 30-40 per team)
- Multiple items of the same heavy weight (bricks, canned goods, wood boards, etc.)

TOOLS:

✓ None

DIRECTIONS:

☐ **Step#1** – Define the Problem

Read along and listen to your teacher explain the **problem** listed above.

☐ **Step#2** – Define the Criteria

Read along and listen as your teacher reads through and explains the **constraints** and **criteria**.

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☐ **Step#3** – Develop Ideas

Complete Round 1 of the challenge according to the directions below.

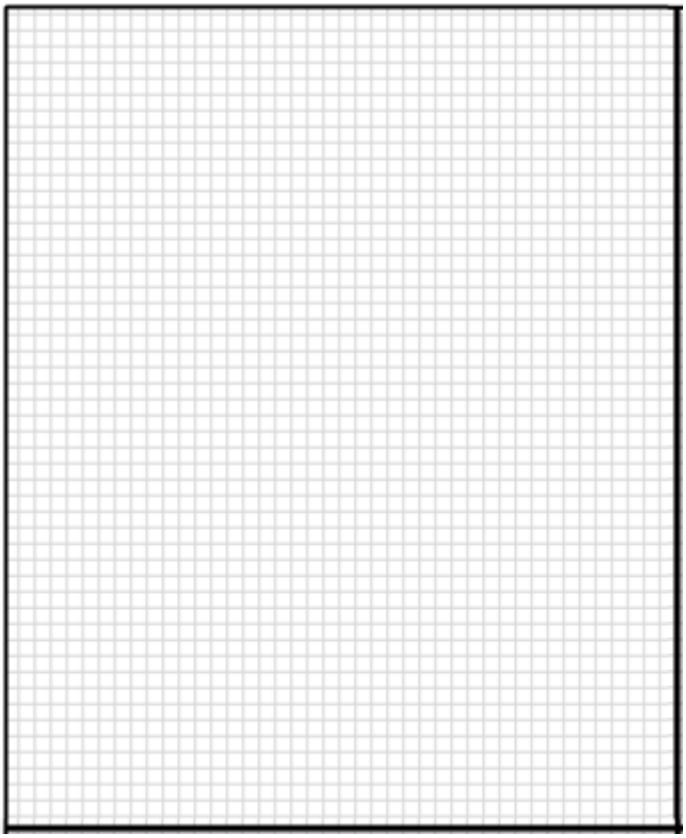
Engineering Challenge - Round 1:

- A timer will be set for 5 minutes.
- In that time, collaborate as a team to use **20 index cards** or less to build a tower that will support 3 items of weight.
- When the time is up, test your tower.
- Record your results below.

Sketch the structure of your tower in the first box. Write a short summary of your results.

Sketch:

Summary:



☐ **Steps #4 & #5**– Develop Solutions, Test & Evaluate

Complete Round 2 of the challenge according to the directions below.

Research Tests - Round 2:

- Complete each of the 3 Shape Research Tests in this round using **10 or less cards total.**
- Cards may be folded, but may NOT be ripped or cut. You may trade for fresh cards between shape tests if your teacher allows.
- Include a sketch of each of the ideas you test. Include labels as needed.
- Write a short summary of your test results.
- Complete the conclusion questions on page 5.

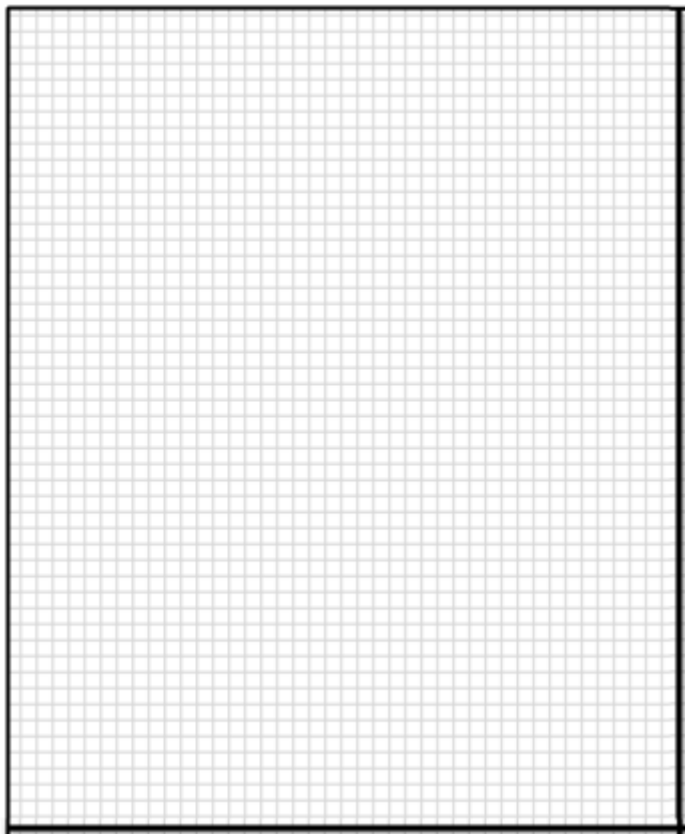
SHAPE TEST #1 – SQUARES & RECTANGLES

Use **10 or less cards** to create square and rectangle shape structures. Test with one item of weight.

Sketch each of the structures you test in the box. Write a short summary of your results.

Sketch:

Summary:



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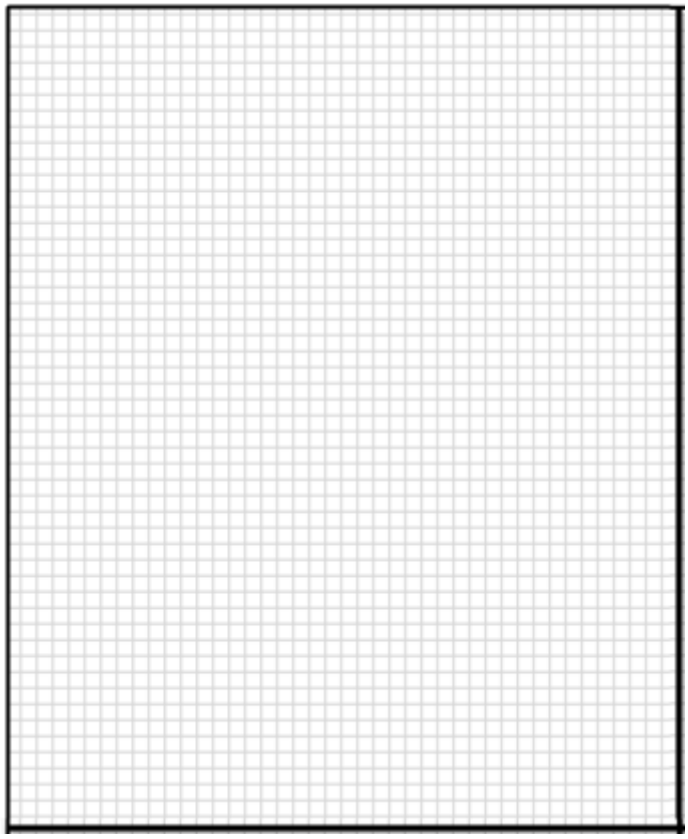
SHAPE TEST #2 – TRIANGLES

Use **10 or less cards** to create triangle shape structures. Test with one item of weight.

Sketch each of the structures you test in the box. Write a short summary of your results.

Sketch:



Summary:

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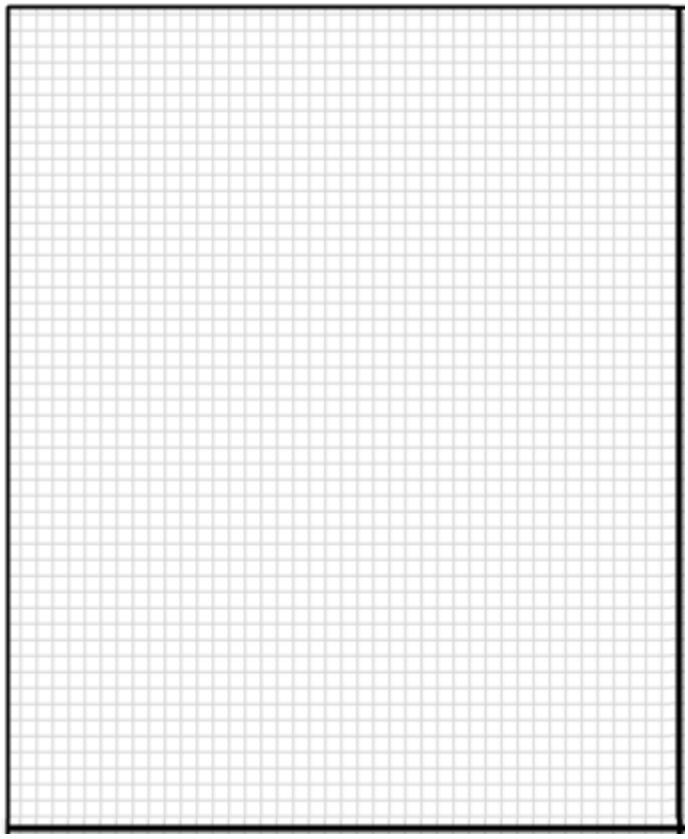
SHAPE TEST #3 – CIRCLES

Use **10 or less cards** to create circle shape structures. Test with one item of weight.

Sketch each of the structures you test in the box. Write a short summary of your results.

Sketch:



Summary:

CONCLUSION: Which shape structure or structures did you find most effective in holding the weight? Which do you plan to include in your final competition tower?

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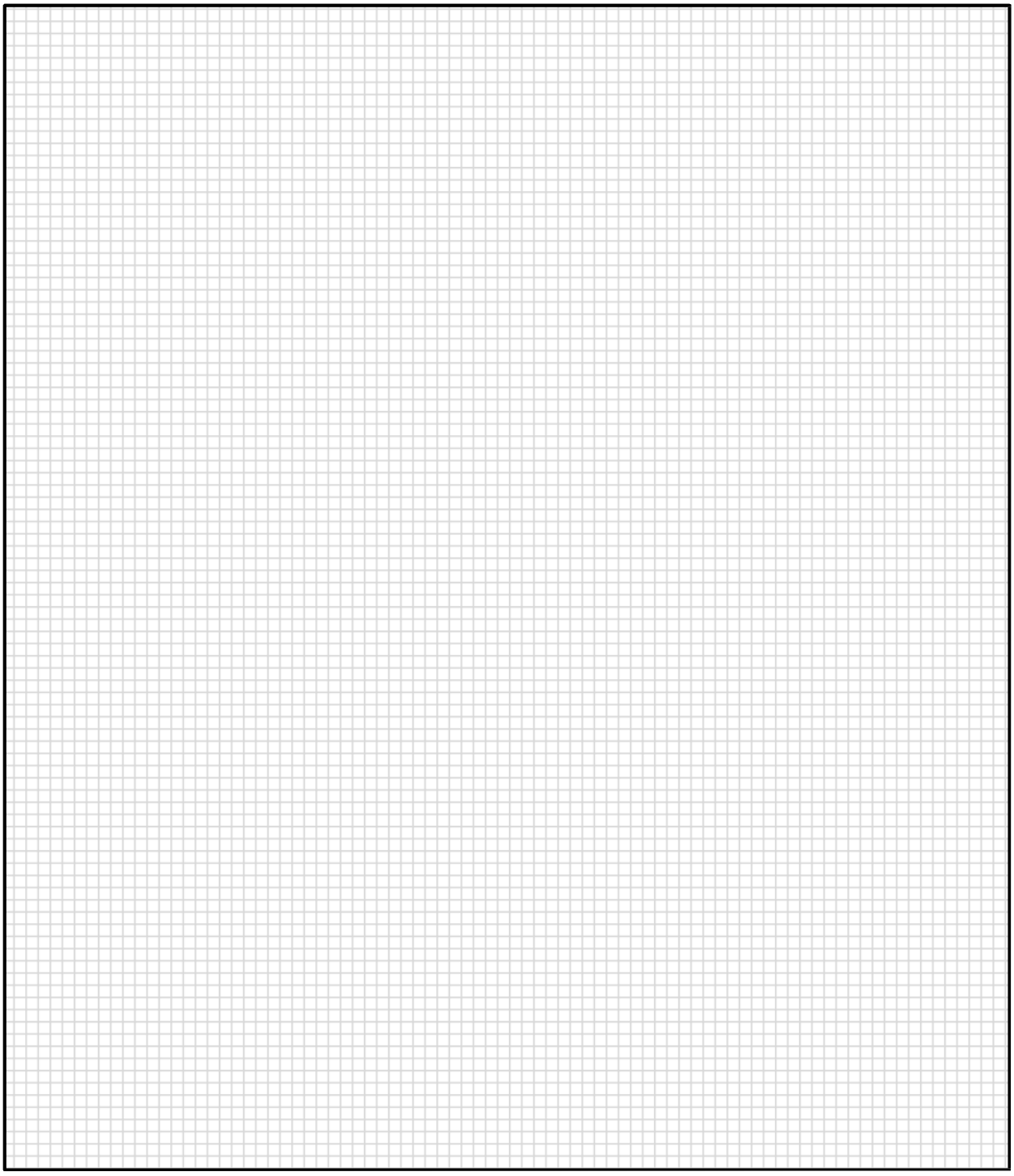
☐ **Step #6** – Present and Produce

Design your final competition tower using shapes you tested or another shape you feel will perform well. Sketch your plan below**.** **<u>Include labels</u>** to clearly identify the different shape structures.



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Final Competition - Round 3:

- **Build** your tower according to your plan – no testing allowed.
- **Present** to your class by sharing what shape structures your used.
- When it's your turn, carefully and strategically stack the weights one by one on your tower. Carefully **observe** the structures and performances of the other towers in the competition.
- **Record** your results below and answer the reflection questions.

# of weights held by your tower	
Greatest # of weights held by your classmates	

Reflection Questions:

1. Describe the performance of your final competition tower. What were it's strengths? What were its weaknesses?

2. Describe the performance of the tower that held the most weight in the class. What structure shapes were used?

3. Describe a tower or structure in the competition that you found to be unique or surprising? How did it perform?

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	Indicator not demonstrated	Indicator partially demonstrated	Indicator adequately demonstrated	Indicator effectively demonstrated
Design Brief & Refection Questions Points___ /4	**Incomplete** Less than 50% complete 1	**Inadequate** Mostly complete; Criterion not met 2	**Adequate** Criterion met; more attention to neatness or detail needed 3	**Exceptional** Meets or exceeds expectations; high effort, attention to detail 4
Sketches & Summaries Points___ /4	**Incomplete** Incomplete or missing more than one constraint requirement 1	**Inadequate** Mostly complete; Criterion not fully met 2	**Adequate** Sketches and summaries are complete and meet constraint requirements 3	**Exceptional** Excellent details in sketches, labels, and summaries 4
Model Build Points __ /4	**Incomplete** Incomplete; No shape structures used or tower unable to compete 1	**Inadequate** Shape structures used are unclear or differ greatly from sketches 2	**Adequate** Tests & build mostly match sketches; shape structures clearly used 3	**Exceptional** Creative or innovative use of shape structures in tests & build 4
Model Presentation Points __ /4	**Incomplete** Team did not present 1	**Inadequate** Not all required information was presented or not presented seriously 2	**Adequate** All required information presented; more detail needed 3	**Exceptional** Exceeds expectations; engaging delivery & much detail 4
Effort & Teamwork Points ___/4	**Incomplete** Team member refused to participate 1	**Inadequate** Frequent reminders needed from teacher and teammates to stay on task 2	**Adequate** Very minimal prompting needed from teacher or teammates to stay on task 3	**Exceptional** Team completed all tasks using effective teamwork strategies 4