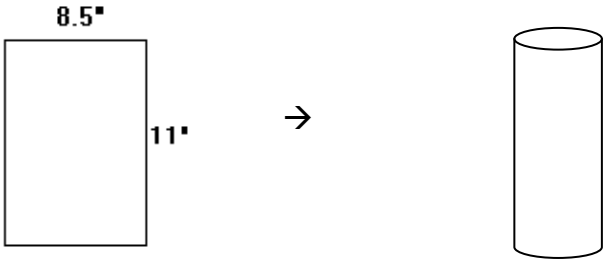
Answer Key – Popcorn Cylinders Anyone?

For this activity you will be comparing the volume of 2 cylinders created using the same sheet of paper. You will be determining which can hold more popcorn. To do this, you will have to find a pattern for the dimensions for containers.

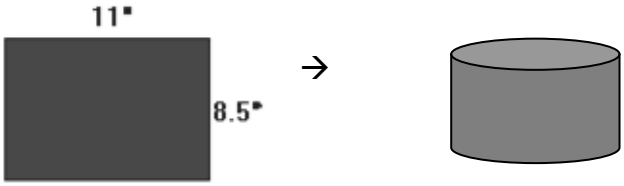
Materials:

- 8.5 inch by 11 inch white paper
- 8.5 inch by 11 inch colored paper
- Tape
- Popcorn
- Plate
- Cup
- Ruler

Take the white paper and roll it up along the longest side to form a baseless cylinder that is tall and narrow. Do not overlap the sides. Tape along the edge. Measure the dimensions with a ruler. Record your data below and on the cylinder. Label it Cylinder A.



Take the colored paper and roll it up along the shorter side to form a baseless cylinder that is short and stout. Do not overlap the sides. Tape along the edge. Measure the height and diameter with a ruler. Record your data below and on the cylinder. Label it Cylinder B.



1.

DIMENSION	CYLINDER A	CYLINDER B
HEIGHT (in.)	[11 in]	[8.5 in]
DIAMETER (in.)	[~2.7 in]	[~3.5 in]
RADIUS (in.)	[~1.4 in]	[~1.8 in]

2. Do you think the two cylinders will hold the same amount? Do you think one will hold more than the other? Which one? Why?

Answers will vary.

3. Place Cylinder B on the paper plate with Cylinder A inside it. Use your cup to pour popcorn into Cylinder A until it is full. Carefully, lift Cylinder A so that the popcorn falls into Cylinder B. Describe what happened. Is Cylinder B full, not full, or overflowing?

Cylinder B is not full. There is still room in the cylinder for more popcorn.

As you share your popcorn snack, answer the questions below.

4. **a)** Was your prediction correct? How do you know?

Answers will vary.

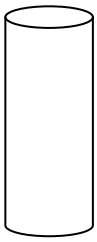
b) If your prediction was incorrect, describe what actually happened.

Cylinder B has a greater volume than Cylinder A.

5. **a)** State the formula for finding the volume of a cylinder.

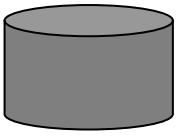
$$V = \pi r^2 h$$

b) Calculate the volume of Cylinder A? Label the dimensions in the figure.



$$V = \pi r^2 h \approx \pi (1.4)^2 (11) \approx 67.7 \text{ in}^3$$

c) Calculate the volume of Cylinder B? Label the dimensions in the figure.



$$V = \pi r^2 h \approx \pi (1.8)^2 (8.5) \approx 86.5 \text{ in}^3$$

d) Explain why the cylinders do or do not hold the same amount. Use the formula for the volume of a cylinder to guide your explanation.

The cylinders have different radii and heights, so the volumes are different.

6. Which measurement impacts the volume more: the radius or the height? Work through the example below to help you answer the question.

a) Assume that you have a cylinder with a radius of 3 inches and a height of 10 inches. Increase the radius by 1 inch and determine the new volume. Then using the original radius, increase the height by 1 inch and determine the new volume.

CYLINDER	RADIUS	HEIGHT	VOLUME
ORIGINAL	3 in	10 in	[~282.7 in^3]
INCREASED RADIUS	[4 in]	[10 in]	[~502.7 in^3]
INCREASED HEIGHT	[3 in]	[11 in]	[~311.0 in^3]

b) Which increased dimension had a larger imact on the volume of the cylinder? Why do you think this is true?

Increasing the radius increased the volume more than increasing the height. This is because the radius is squared to find the volume, which increases its impact on the volume.

7. By how much would you have to decrease the height of Cylinder B to make the volumes of the two prisms equal?

$$V_A \approx 67.7 \text{ in}^3$$
$$V_B \approx 67.7 \text{ in}^3 = \pi(1.8)^2(h)$$
$$h \approx 6.7 \text{ in}$$

The height would need to be decreased by about $8.5 - 6.7 \approx 1.8$ in.

8. Compare and contrast your results from the prism activity and the cylinder activity. What conclusions can you make about the relationship between dimensions, area, and volume?

Answers will vary. Students may point out the similarity in the volume formulas $V = l^2h$ and $V = \pi r^2 h$ and how this effected their results.