

## **LESSON 2 - HOW WATER IS DELIVERED**

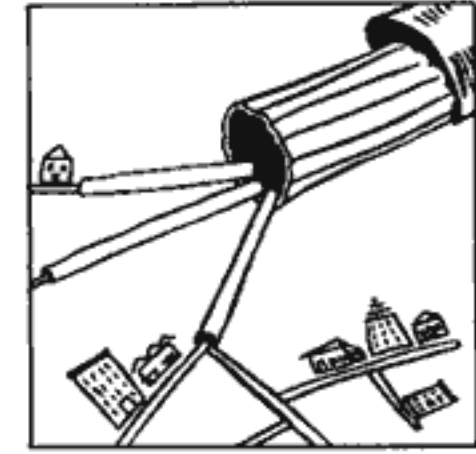
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The activities in Lesson 2 explore the systems that deliver water to families and communities. The pipes, valves and connections are mostly behind walls or under the ground, so students have little direct knowledge of them. But they are the next logical step in understanding where our water comes from.

The first two activities, How Much Water Do Containers Hold? and Which Pipe is Bigger? examine the volume of different containers and pipes. They will first estimate comparative volumes, then use water to test their predictions. The next activity, Different Diameter Pipes, combines language arts skills (“The Story of Drip and Drop”) with the geometry of circles and cylinders to think about how much water different pipes can carry. Finally, using every day objects, students create a model of a water delivery system (Building a Water System).

The first two activities in Lesson 2 require water to test predictions. These activities will therefore be very engaging for students, but also potentially messy. We suggest careful preparation to control the water and a generous supply of paper towel for clean up.

## Lesson 2 How Water is Delivered



### ACTIVITY 2-1 HOW MUCH WATER DO CONTAINERS HOLD?

**SUMMARY** Students will estimate container sizes and then test their estimations using water.

**CONTENT AREAS** math, science

**GOAL** to experience different amounts of water in different size containers and to become familiar with volumes of water

**TIME** one session

**MATERIALS** for each group: about five different containers that will hold water (kit) (possibilities include: margarine tubs, yogurt containers, liquid soap containers, baby bottles)

- pitcher for water (kit)
- paper towels
- funnel
- graduated cylinder for extension activity (kit)



#### ADVANCE PREPARATION

- Group containers in sets of five.
- Fill pitchers with water.
- Put materials on table available to students.
- Create student working groups.

#### TEACHER PROCEDURE

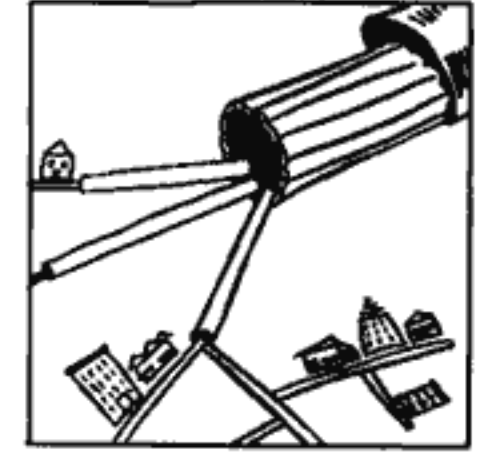
1. Each group of students should get a set of materials. Each group does not need an identical set of containers.
2. Students should order the containers from the one they think would hold the most water to the one they think would hold the least. (most volume to least volume)
3. Students test their predictions by using water.
4. After containers are ordered, students should explain their method for solving the problem.

#### EXTENSION

Estimate the volume of the containers in milliliters. It will be helpful if students know that a 1-liter bottle holds 1,000 milliliters. They should check their estimations using a measuring cup and then a graduated cylinder. Which is more accurate?

## Lesson 2 How Water is Delivered

### ACTIVITY 2-2 WHICH PIPE IS BIGGER?



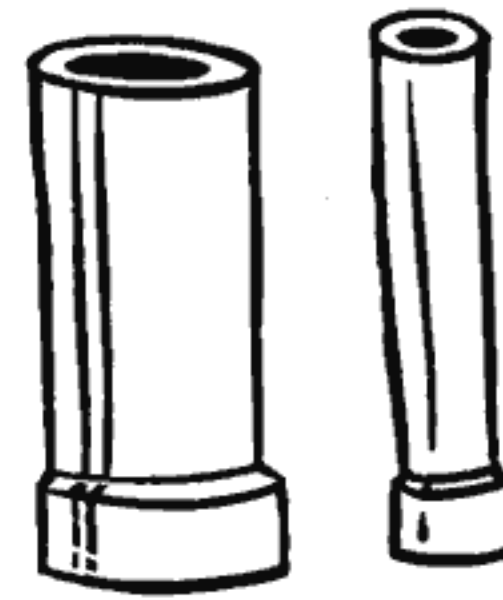
**SUMMARY** Students will compare pairs of pipes and predict which has the greater volume. Then they will test their predictions using water.

**CONTENT AREAS** math, science

**GOAL** to understand that volume is important in pipe size and to gain experience with measures of volume

**TIME** one session

**MATERIALS** for class:  
-10 pairs of pipes labeled A1,2 - J1,2 (kit)  
-10 pitchers of water (kit)  
-10 plastic basins or tubs  
- paper towels



#### ADVANCE PREPARATION

- Fill pitchers with water.
- Put pipes on materials table available to students.
- Create student working groups.
- Copy student pages.

#### TEACHER PROCEDURE

1. Each group of students should get one pair of pipes (ex: A1 and A2) and a pitcher of water and bring it back to their table.
2. The group should decide by looking at the pair of pipes which one they think is bigger. They should record their predictions on the data form.
3. The group will then use water to determine which pipe holds more. One student will need to hold the pipe as another is pouring water into it. Students work over plastic basins to minimize water mess.
4. Groups record their information on the data page.
5. Students trade pipes with another group.
6. They continue until they have tried at least five pairs.

# Which Pipe is Bigger?

**Introduction:** Sometimes it is hard to tell the size of something just by looking at it. In this activity you will look at pairs of pipes and predict which one is bigger. Then you will test your prediction using water.

**Materials**

- 5 or more pairs of pipes
- one container of water
- plastic basin or tub
- Pipe Data Table

## Procedure

1. Get one pair of pipes and bring it back to your table.
2. Look at the pair of pipes and predict which one is bigger. (Which one will hold more water.)
3. Record your prediction on the data table.
4. Test your prediction by pouring water in your pipes and seeing which holds more water. (Hint: one student should hold the pipe in the plastic tub while another student pours the water)
5. Record your results on the data table.

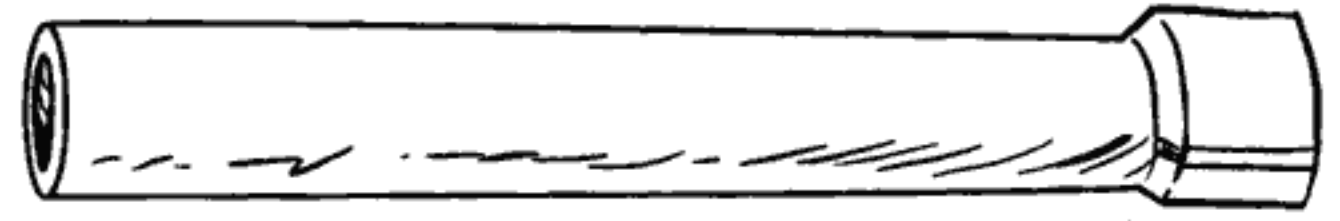
# Which Pipe is Bigger?

6. Trade pipes with another group and repeat steps 2 through 5.
7. Continue trading with other groups until you have worked with at least five pairs of pipes.
8. Return your water container and last set of pipes to the materials table.
9. Wipe up any spilled water and dispose of towels.



Name \_\_\_\_\_ Date \_\_\_\_\_

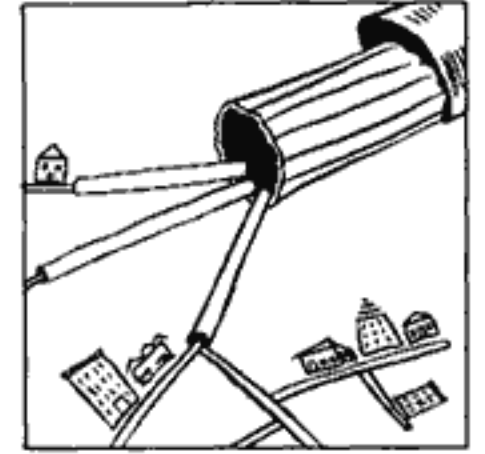
# Pipe Data Table



Pipes	Prediction (Looks Bigger?)	Result (Holds More Water?)
A1, A2		
B1, B2		
C1, C2		
D1, D2		
E1, E2		
F1, F2		
G1, G2		
H1, H2		
I1, I2		
J1, J2		

## Lesson 2 How Water Is Delivered

### ACTIVITY 2-3 BUILDING A MODEL DELIVERY SYSTEM



**SUMMARY** Students will build a model of a water system using pasta to represent pipes.

**CONTENT AREAS** science, social studies

**GOAL** to understand the basic structure of a water system

**TIME** one session

**MATERIALS**

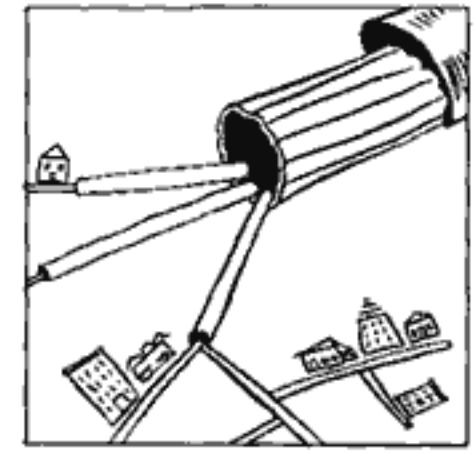
- large piece of paper or cardboard
- materials bag (kit) containing:
  - different sizes of pasta (ziti, spaghetti, etc.) to represent pipes
  - paper towel tubes
  - straws
  - pictures of buildings (included in the curriculum)
- crayons or markers
- glue (optional-for gluing pasta on cardboard)

#### ADVANCE PREPARATION

- Create student working groups.
- Have large piece of cardboard for each group.
- Have materials available to students.



## Lesson 2 How Water Is Delivered



### ACTIVITY 2-3 BUILDING A MODEL DELIVERY SYSTEM

#### TEACHER PROCEDURE

1. Discuss with students how water gets to the homes and buildings of a community. Emphasize that water leaves a reservoir through a tunnel (an aqueduct) and that pipes branch off and lead to the water mains in different communities. The community's smaller pipes branch off the water main.
2. Have available to each small group of students (2-4) a materials bag and a large piece of paper or cardboard.
3. Explain to students that they will use the materials in the bag to create a model of a water system. The pasta will be the pipes. They will use the drawings of buildings (school, factory) and the reservoir to represent those items in their model. Students may also want to draw apartment houses and homes for their community. They also may want to glue their pieces down on the large paper.
4. When projects are complete, students can look at other groups to see how they might have done theirs differently. Discuss some of the benefits to the different ways that students constructed their systems.
5. The questions at the end of the lesson can be used as guidelines for a class discussion or as written questions for students.





# Building a Water System

**Introduction:** You use lots of water every day. Where does that water come from and how does it get to you? During this activity you will build a model water system using pasta and pictures of buildings.

- Materials**
- bag of building materials
  - large piece of cardboard or paper
  - crayon or marker
  - glue (optional)



# Building a Water System

## Procedure

1. Think about how water gets to your faucet every day. You may have a class discussion on this topic.
2. Get your materials.
3. Put your buildings on your paper.
4. Draw more buildings (maybe homes) on the paper.
5. Plan with your group how this water system should be built. First decide where the reservoir will go. Then plan where the pipes should go.
7. Look at other groups' models to see what they did differently from your group.
8. Return extra pasta and buildings to the materials bag. Return those to your teacher.
9. Clean-up any glue, pasta, or scraps of paper that may have spilled.

# Building a Water System

## Conclusion

1. Why did you have different pipe sizes in your materials bag?

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2. Describe the water system you created.

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# Building a Water System

## Conclusion

3. Was it difficult for your group to agree on how to build the system? Explain how your group made the decision.

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4. Describe how your system is different from those of other groups in your class.

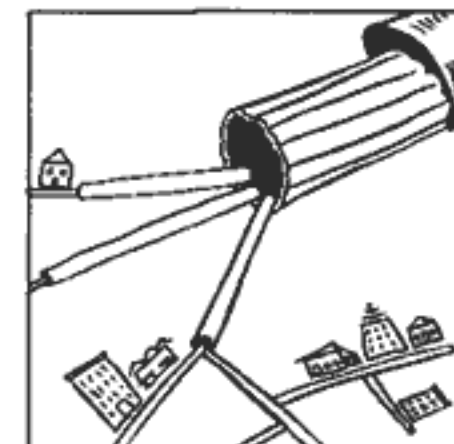
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## Lesson 2 How Water Is Delivered



### ACTIVITY 2-4 DIFFERENT DIAMETER PIPES

**SUMMARY** Students will read a story and use a template to draw four different diameter pipes based on their reading. They will use construction paper to create pipes.

**CONTENT AREAS** reading, math

**GOAL** to experience the different diameters of pipes in the water system

**TIME** one session

**MATERIALS**

- Drip and Drop's Adventure (curriculum)
- pencil
- compass or 1 inch to 10 inch diameter templates (kit)
- large piece of paper-- approximately 21" x 26"  
(one quarter must be big enough for a 10" diameter circle)
- ruler, crayons or graph paper
- construction paper, scissors

#### ADVANCE PREPARATION

- Copy story and student pages for students.
- Prepare large paper for pairs of students - exact size is not important.
- Create student working pairs.

#### TEACHER PROCEDURE

1. Read the story with the students. You may want students to preread the story and then have individuals read aloud with the class.
2. Working in pairs, students will complete the student pages by answering questions and drawing the correct diameter pipes.
3. Students can roll construction paper to make four pipes that have the same diameter as the ones they have drawn on the student page.
4. You may want to have students connect their construction paper pipes in the same way they are connected in the story.

#### EXTENSION

When they have completed the pipes they can compare the diameters in two different ways. They can see how long it takes to color each pipe. Or they can trace the pipes onto graph paper and count squares to estimate area.

# Drip and Drop's Adventure

Drip and Drop lived with many other water drops in a quiet, beautiful place called Wachusett Reservoir. They played happily with their friends, watching the sea gulls, admiring an old stone church nearby, and greeting the sun and moon each day.

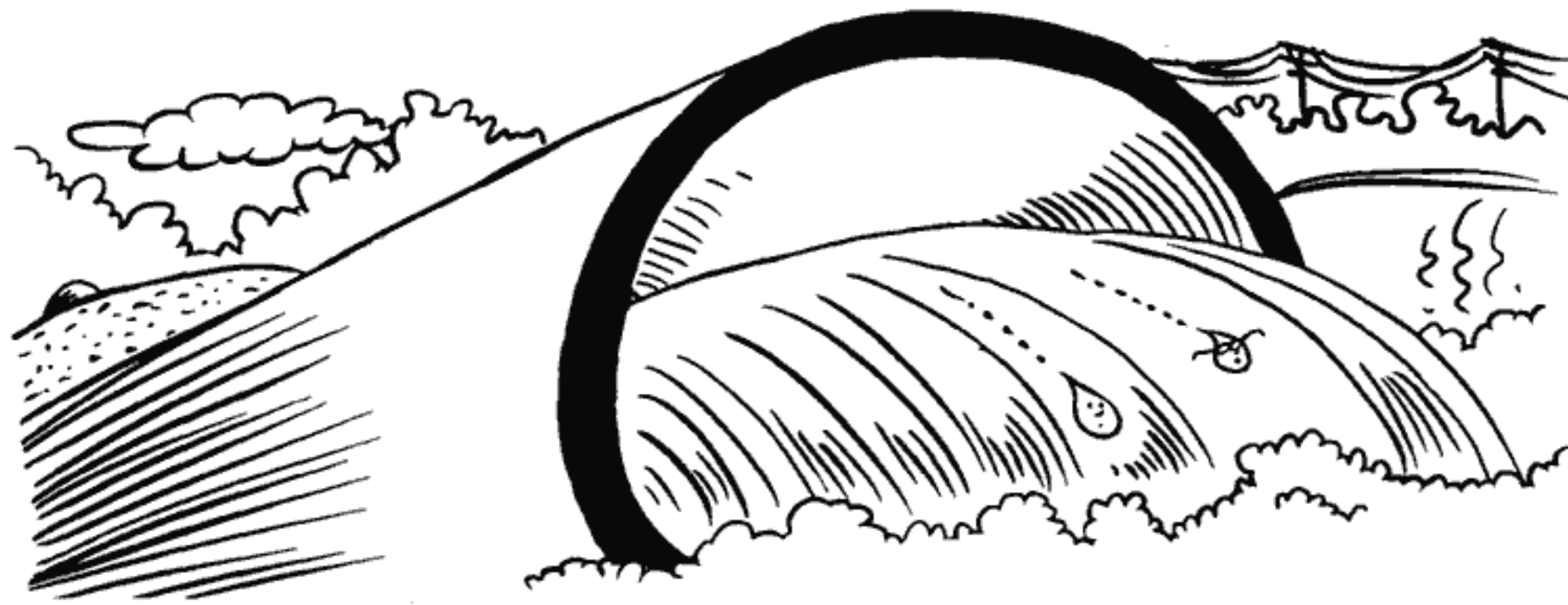
Suddenly one day, everything changed. With a big rush and whoosh, and a quick smell of chlorine, they were swept into the dark, moving very fast. Exploring by touch, they learned they were in a tunnel about fourteen feet across. After two hours, the pipe narrowed to twelve feet across.

On they rushed, hearing names like Framingham and Weston. They caught another smell of chlorine as they passed through Weston. They remembered Wachusett Reservoir and wondered when they would see the light again.

Changes came more quickly now. There were more turns and corners in the tunnel, and some of their friends were drawn off into other pipes. Drip and Drop stayed together, though, enjoying their long fast ride in the dark, wondering where it would lead.

At a fork in the tunnel, they entered a pipe just three feet across, and then one just twelve inches across! Someone said they were right beside a large hospital.

# Drip and Drop's Adventure



A few blocks later they entered a six inch pipe. They learned they were under a street, in a neighborhood, right by a school.

They spent a sleepy night, moving very slowly, but then things began to quicken again. They squeezed into a one inch pipe and were carried into a three-family house. Inside the house, a 1/2 inch pipe carried them behind a wall toward a bathroom sink. At last they saw the light again, and they were very excited. They rushed happily onto a child's toothbrush as she got ready for school.

They were so pleased to see the light that they stayed around the sink for a while. Finally they carried some toothpaste down the drain into a new set of pipes. After a time, they began to meet more of their old friends again and hear of their adventures, but that's another story.

# Different Diameter Pipes

1. What was the name of the reservoir where Drip and Drop lived?

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2. Where did Drip and Drop smell chlorine?

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3. What was the largest pipe that Drip and Drop travelled through?

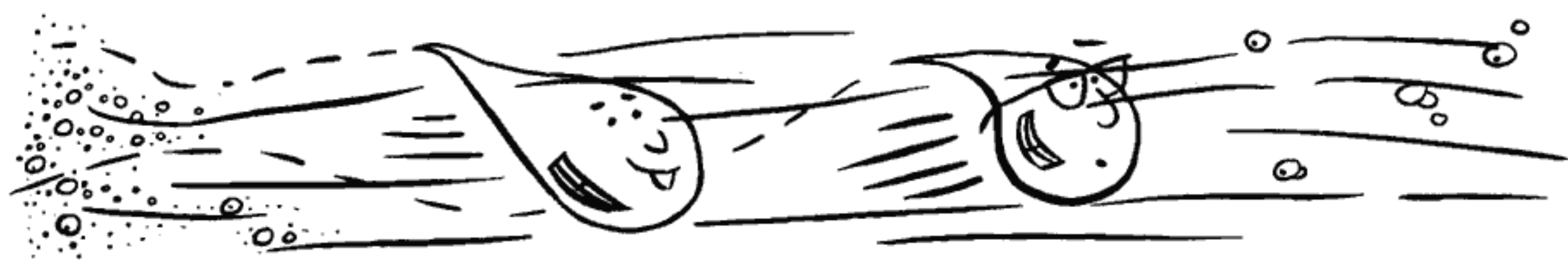
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4. Did the pipes get bigger or smaller as Drip and Drop travelled toward the apartment house?

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# Different Diameter Pipes

Fold the large paper your teacher has given you into fourths. Number it as shown below.

5	6
7	8

## Procedure

5. In space # 5 of your large paper draw the pipe that Drip and Drop entered near the hospital.
6. In space #6 draw the pipe Drip and Drop were in under the street right by the school.
7. In space #7 draw the pipe that took Drip and Drop past the foundation of a three family house.
8. In space #8 draw the last pipe that Drip and Drop were in.
9. Roll up construction paper to create pipes with the same diameters as the ones you drew in spaces 5-8.
10. Connect the pipes as they are connected in the story.