TEACHER GUIDE: START HERE

Fire Sprinkler Systems and Careers

An introductory lesson with one shared demonstration kit

Grades 9-12 | One 50-minute class | Five student activity pages

Introduce the parts of a fire sprinkler system, show how water moves and is sprayed, and help students connect the experience to a career in the fire protection industry. The whole class follows one kit while a few rotating helpers handle parts the teacher has approved.

Demonstration only. The parts in this kit are used solely to demonstrate basic mechanical components, water supply and flow, and how water is discharged and distributed from a sprinkler. The parts are not necessarily listed, approved, or permitted for use in a fire sprinkler system. This kit cannot protect a room or building and must not be replicated or used as a system design, installation standard, or substitute for applicable codes, standards, listing requirements, manufacturer instructions, or approval by the authority having jurisdiction. Requirements of the applicable jurisdiction take precedence for every actual installation.

What students will learn

- Recognize the ball valve, check valve, and sprinkler head, and trace the water route.
- Explain how heat activates a glass-bulb sprinkler and why this open demonstration head needs no heat.
- Read a ruler marked in eighths of an inch.
- Choose a fire sprinkler career they would like to explore.

The essential activities

Activity	Time	Student page
Explore the kit, demonstrate, and compare sprinkler heads	25 minutes	9–11
Try a measurement	10 minutes	12
Explore a career and share	15 minutes	13

Get ready for one class

Gather and copy

- One demonstration kit, its approved assembly reference, and its operating instructions.
- One copy of pages 9-13 per student and a pencil. Retain pages 1-8 and 14 for the teacher.
- Display pages 5–8 or provide one copy per pair. Use the assembly reference for connection order and orientation.
- Have the Become a Life-Saver PowerPoint from the downloadable bundle ready for career exploration.

Print page 12 at 100% or Actual Size. Turn off Fit to Page. Check the distance from 0 to 2 with a physical ruler before copying.

Set up so everyone can participate

Place the kit where everyone can see it. The preglued base is one fixed unit: the hose-end male adapter, mounted pipe, elbow, lower pipe nipple, and ball valve stay together. Helpers may identify parts, help with designated upper connections, or measure a separate loose pipe section. Everyone completes the student pages.

Choose the demonstration method

Before class, review the supplied kit instructions. Inspect the preglued base and confirm its joints have completed the manufacturer-required cure before water use. [3] Identify which upper connections students may handle. Rehearse the demonstration. Inspect and secure the remaining upper connections before water use.

WARNING: Check valve flow arrow must point UPWARD toward the sprinkler. Backward installation can block flow and pressurize the upstream section (hose side), potentially forcing connections apart. Check direction before turning on water. Never test backward.

For water use, provide eye protection for everyone present and a stable splash area with drainage or collection. Keep electrical equipment away. The teacher controls the supply and valve. Students stand clear of the outlet and keep hands off connections while water is supplied. Use no flame, heat, or compressed air.

Without approved instructions or a suitable splash area, use the dry kit. Trace the route and discuss the expected effect of each valve position. Students mark their response dry demonstration.

Pressure and Connection Safety

This demonstration kit is intended for use with a garden hose at normal household water pressure. The base is supplied preglued and should remain intact. Keep hands and faces clear and wear eye protection. If any connection leaks, moves, or separates, shut off the hose supply and let pressure and water drain. Stop using a damaged glued joint; do not push it back together or reglue it in class. The instructor checks any removable connection before further use. Stop if any part is cracked, damaged, loose, or will not remain connected.

Keep handling simple.

Disconnect the water source before handling. Keep the entire preglued base and its supports intact. Students handle only designated upper parts. Do not twist, pull apart, cut, or reglue the base, and do not add cement or sealant during the activity.

Lead the three activities.

1. Explore and demonstrate 25 minutes

Open with: This model shows a water path through a sprinkler system. We will follow the water and explore the jobs behind the system.

Point to	Explain in one sentence
Ball valve	Turning the handle opens or closes the water path. The handle shows whether the valve is open or closed. If it lines up with the pipe, the valve is open. If it crosses the pipe, the valve is closed.
Check valve	It allows flow in its intended direction and resists reverse flow; the arrow shows that direction.
Open sprinkler head	Water leaves here; the deflector helps spray it. This head is already open.

Identify and trace. Show the preglued base as one unit. Use page 6 to prepare the remaining upper section with supervised helpers. Partners trace the full water path using pages 5–8. Explain that the exploded view shows individual parts, including fixed joints that students must leave intact. Students begin page 9.

WARNING: Check valve flow arrow must point UPWARD toward the sprinkler. Backward installation can block flow and pressurize the upstream section (hose side), potentially forcing connections apart. Check direction before turning on water. Never test backward.

Conduct the demonstration. Students predict what closing the ball valve will do. After inspecting the preglued base and completed upper section, follow the demonstration steps on page 7. Stop at the source for movement, leaks, or escaping splash. Shut off and drain before handling. Students record results on page 9.

Explore the head and bulb. Spend about 10 minutes on pages 10–11 within this 25-minute block. Model the picture and first comparison, then let partners finish. Use page 14 for answers. Do not heat or break bulbs.

2 Try a measurement for 10 minutes

With the kit disconnected and drained, use page 12. Count eight spaces per inch; show 4/8 = 1/2 inch. Read A together; students try B alone. A helper may measure a separate loose pipe section. Do not remove a glued section to measure it.

3 Explore a career: 15 minutes

Show the career slides in the Become a Life-Saver PowerPoint, included in the downloadable bundle. Ask which jobs connect to the kit tasks students enjoyed. On page 13, students choose a role, explain their interest, and write a question. Invite partner sharing. For further research, use firesprinklerjobs.org.

Each student names one part and its purpose. Collect pages 9–13 and use the key to give feedback.

Check understanding.

Page 9: Explore the kit.

Part matches: ball valve = manual flow control; check valve = intended flow direction and resistance to reverse flow; open sprinkler head = water outlet and distribution.

Flow route: brass quick-connect hose coupling > male adapter > preassembled base > 90-degree elbow > PVC pipe nipple > ball valve > PVC pipe nipple > male adapter > check valve > male adapter > PVC pipe nipple > female adapter > open sprinkler head.

WARNING: Check valve flow arrow must point UPWARD toward the sprinkler. Backward installation can block flow and pressurize the upstream section (hose side), potentially forcing connections apart. Check direction before turning on water. Never test backward.

The lower pipe nipple, elbow, ball valve, base pipe, and hose-end male adapter are now part of the preglued base. Leave them intact. The two upper nipples connect the remaining upper components. The check-valve flow arrow must point upward toward the sprinkler head. Numbers identify parts, not student assembly steps.

Closing the ball valve stops sustained flow after remaining water drains. An available supply and a clear open path allow discharge from the head. For dry lessons, record a prediction.

The kit head releases water without heat because its outlet is already open. A typical automatic sprinkler stays closed until heat activates it. The model does not show activation or building-system performance. [1]

Pages 10–11: Head and bulb activity — teaching notes and answers are on page 14.

Page 12 Try a measurement

A = 1 3/8 inches. B = 1 3/4 inches. Count spaces from zero, not the ruler's physical edge. Accept the actual teacher-checked measurement for the shared pipe section. Students do not add lengths or calculate fitting allowances in this introductory lesson.

Page 13 Explore a career

Show the career slides in the Become a Life-Saver PowerPoint, included in the downloadable bundle. Ask students which jobs connect to the tasks they enjoyed during the kit activities.

On page 13, students choose one career, explain why it interests them, and write a question about the work. Have them share with a partner.

For further research, direct students to firesprinklerjobs.org to explore careers and training opportunities.

If a student needs help

Point to the actual part, retrace the water path together, or count ruler spaces aloud. Read directions aloud and accept a spoken response when needed. Invite students to correct one answer after feedback.

Teacher sources and next steps

[1] Pennsylvania Office of the State Fire Commissioner
www.pa.gov/agencies/osfc/communities/home-sprinklers
[2] AFSA career information
www.firesprinklerjobs.org/careeroptions/
[3] Charlotte Pipe Plastics Technical Manual
View the manufacturer’s technical manual

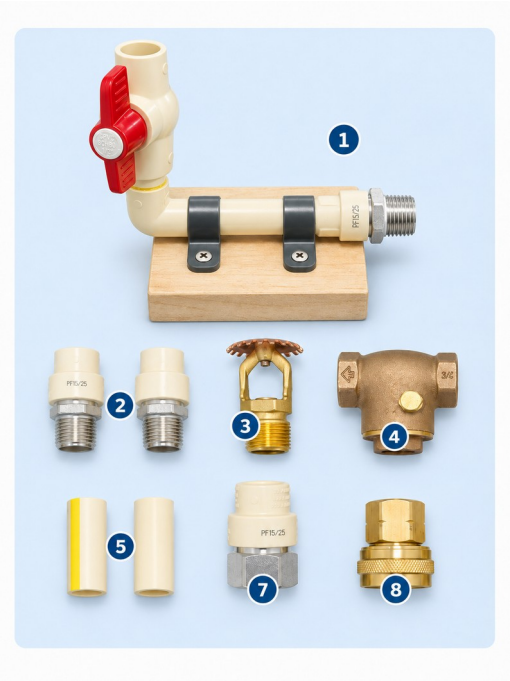
Use the supplied assembly reference and kit operating instructions for setup and demonstration. *This introductory experience does not qualify students to install or service a building system.*

CLASSROOM REFERENCE DISPLAY OR SHARE

Identify the components

Use this view to identify the parts supplied with the kit. Component 1 is the complete preglued base unit; its parts are listed below. Leave that unit intact.

Open sprinkler note: The open sprinkler is used only for this demonstration. Most automatic sprinklers have a heat-sensitive operating element, commonly a glass bulb, that activates when exposed to sufficient heat at its rated temperature.

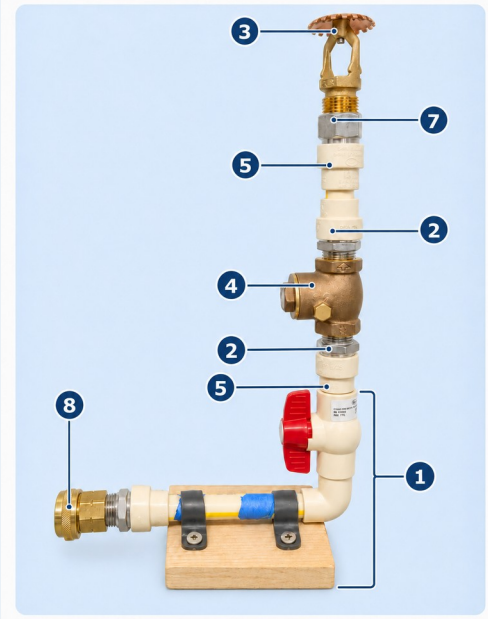


No.	Component	No.	Component
1	Preglued base: wooden board, mounted pipe, U-hooks and screws, hose-end male adapter, 90-degree elbow, lower pipe nipple, and ball valve with red handle.	2	PVC-to-metal male adapters | 2 loose pieces
3	Open sprinkler head with no heat-sensitive element	4	Brass check valve
5	PVC pipe nipples | 2 loose pieces	7	PVC-to-metal female adapter | 1 piece
8	Brass quick-connect hose coupling		

CLASSROOM REFERENCE DISPLAY OR SHARE

Prepare the complete demonstration kit

The image shows the completed demonstration kit. Unit 1 is the preglued base; keep it intact while assembling the upper section.



Completed kit with preglued base (1)

Leave the preglued base intact

Do not assemble or dismantle the hose-end adapter, base pipe, elbow, lower nipple, or ball valve.

Complete the upper section

1. Keep the water source off and disconnected. Set the base flat and support it. Part numbers in parentheses below match the diagram.

2. Above the ball valve in base unit (1), arrange: pipe nipple (5) > male adapter (2) > check valve (4) > male adapter (2) > pipe nipple (5) > female adapter (7) > open sprinkler head (3).

3. With teacher supervision, join only the designated removable connections using the supplied kit instructions. The check-valve flow arrow must point upward toward the sprinkler head.

WARNING: Check valve flow arrow must point UPWARD toward the sprinkler. Backward installation can block flow and pressurize the upstream section (hose side), potentially forcing connections apart. Check direction before turning on water. Never test backward.

4. The teacher checks all connections and the open outlet before connecting the hose. Students do no gluing, cutting, or forced fitting.

HOW TO SPRAY WATER SAFELY

WARNING: Check valve flow arrow must point UPWARD toward the sprinkler. Backward installation can block flow and pressurize the upstream section (hose side), potentially forcing connections apart. Check direction before turning on water. Never test backward.

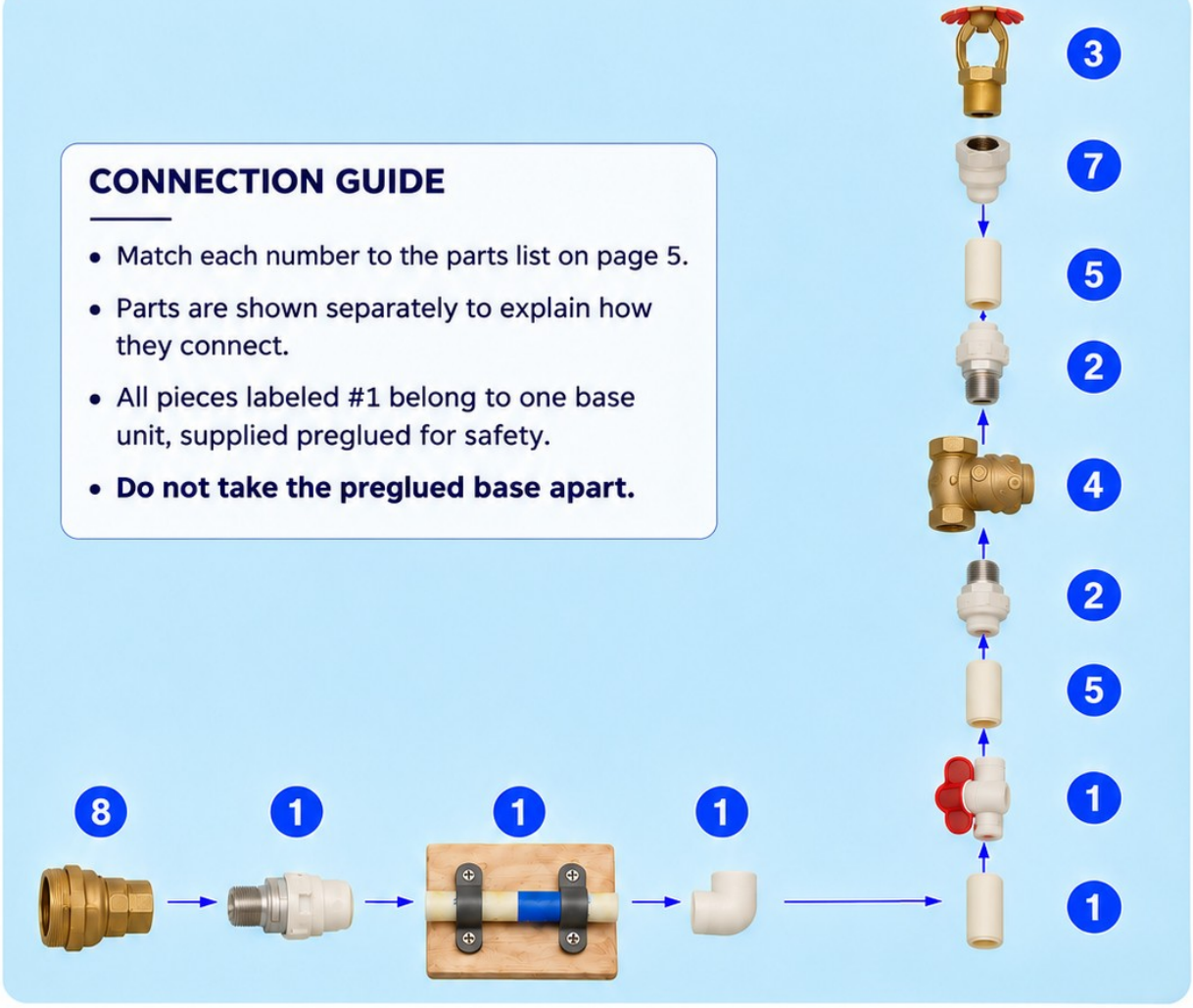
1. Move the kit to a stable outdoor or approved splash area. Keep people, electrical equipment, and valuables clear; wear eye protection.
2. Inspect and support the fixed base and upper section. Confirm the check-valve flow arrow points upward toward the sprinkler and the ball valve is closed (the handle crosses the pipe).
3. With the water off, hook the brass quick-connect coupling to the garden hose.
4. At the hose connection or faucet, slowly turn on the water only partway.
5. Stand clear of the sprinkler. Slowly open the red-handled ball valve until the handle lines up with the pipe. Water will spray from the open sprinkler.
6. Use a garden hose at normal household water pressure. Adjust the hose flow for a visible spray pattern.
7. To stop, close the ball valve, shut off the hose supply, and let all pressure and water drain before disconnecting.

IF A CONNECTION LEAKS OR SEPARATES: Shut off the hose supply and allow pressure and water to drain. Stop using a failed glued joint. Do not push it back together or reglue it in class. The instructor inspects removable connections before any further use. Stop if a part is damaged, loose, or will not stay connected.

Demonstration only. The parts in this kit are used solely to demonstrate basic mechanical components, water supply and flow, and how water discharges and is distributed from a sprinkler. The parts are not necessarily listed, approved, or permitted for use in a fire sprinkler system. This kit cannot protect a room or building and must not be replicated or used as a system design, installation standard, or substitute for applicable codes, standards, listing requirements, manufacturer instructions, or approval by the authority having jurisdiction. Requirements of the applicable jurisdiction take precedence for every actual installation.

EXPLODED ASSEMBLY VIEW

Fire sprinkler demonstration kit



CONNECTION GUIDE

- Match each number to the parts list on page 5.
- Parts are shown separately to explain how they connect.
- All pieces labeled #1 belong to one base unit, supplied preglued for safety.
- **Do not take the preglued base apart.**

CHECK VALVE SAFETY

Check valve #4: arrow must point UP.

The flow arrow on the valve body must point upward toward the sprinkler head.

A downward-facing valve can block water flow and pressurize the upstream section. This may force connections apart.

Check the arrow before turning on the water.

STUDENT ACTIVITY 1 OF 4

Explore the kit.

Name _____ Date _____

Use the shared kit and reference images. Keep the preglued base intact. Handle upper parts only when the teacher directs you. Talk with a partner before writing.

Find three important parts.

Write the part that matches each job.
Word bank: ball valve | check valve | open sprinkler head

1. Turning its handle opens or closes the water path.

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2. Its arrow shows the intended flow direction.

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3. Water leaves through this part.

USE THE SCIENTIFIC METHOD

Safety: Observe installed sprinklers only with teacher permission. Stay on the floor. Do not touch, test, paint, block, or hang anything from a sprinkler.

1. Observe: Find one installed sprinkler in an approved area. Record its location, orientation, and anything nearby.

_____

_____

2. Question: What happens to the water flow and spray pattern as the ball valve moves from open to closed?_____

_____

3. Hypothesis: If the ball valve closes, then _____ because _____.

4. Test: During the teacher-led demonstration, observe the spray with the valve open and as it is slowly closed. If no water is used, complete a dry demonstration.

5. Evidence: Write or draw what happened.

6. Conclusion: Was your hypothesis supported? Explain using your evidence.

_____

Explain one difference

Why can this kit release water without heat?

Meet the sprinkler head and bulb

Name _____ Date _____

A typical automatic sprinkler stays closed until enough heat opens it. A connected water supply provides the water. Start by finding its parts in this illustration.



Find these parts in the picture

Glass bulb: the red-filled tube in the center. It holds a small seal closed until enough heat activates the sprinkler.

Deflector: the scalloped plate at the top. It helps spread the water into a spray pattern.

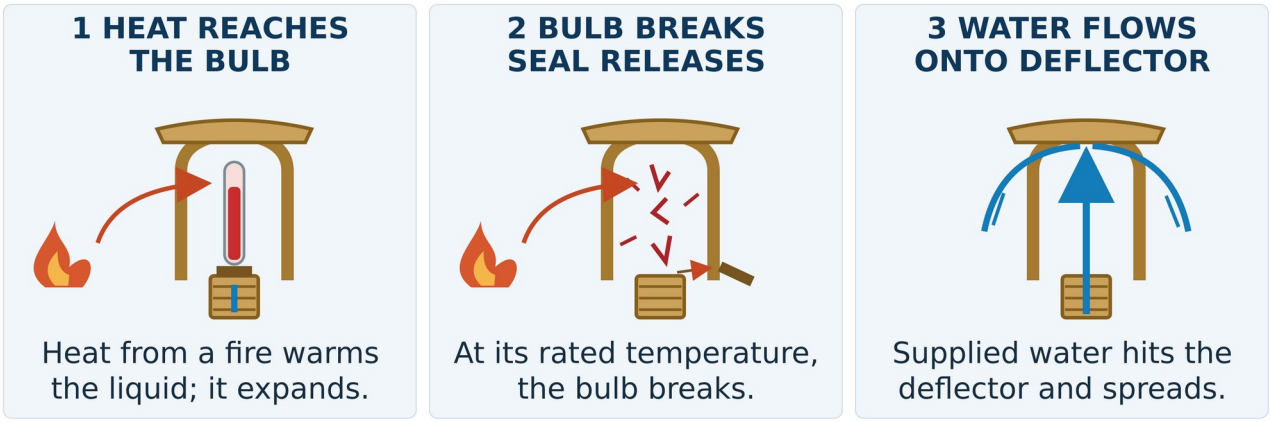
Frame: the brass arms supporting the parts.

Pipe connection: the threaded end at the bottom, where water enters from the pipe.

Seal: a small closure inside the water outlet. It is not visible inside this illustration.

Illustration: an intact upright glass-bulb sprinkler. The kit uses an open head without a bulb.

How it opens



As the liquid inside the bulb heats up, it expands and takes up more space. The sprinkler is designed to activate when the bulb reaches its rated temperature, such as 155°F (68°C), even if other parts of the room remain cooler. Each sprinkler responds individually to heat. Smoke does not activate it. Once the sprinkler opens, water from the connected piping flows through it to control the fire. The liquid inside the bulb serves only as part of the heat-sensitive trigger. [4, 5]

Why the kit has no bulb

The kit head is already open so we can demonstrate water flow without heat. With water supplied, the ball valve starts or stops flow to the head. The kit does not demonstrate automatic heat activation.

Try one together: Point to the deflector and say, “It spreads the water.” Your turn: point to the bulb and explain its job.

Observe only. Never heat, break, or remove a bulb. Do not touch or test installed sprinklers. Keep the kit disconnected and drained while observing it.

Explain what makes water flow

Name _____ Date _____

Use the picture and reading on page 10. Work with a partner, then explain one answer to the class.

1 Compare the heads

The first row is completed as an example. Use “open” or “closed” for the second row. In the last row, describe what allows supplied water to flow.

Feature	Typical glass-bulb sprinkler	Open demonstration head
Bulb present?	Yes	No
Outlet before water flows?		
What opens the water path?		

2 Put the events in order

Write 1, 2, and 3 beside these events for a typical automatic glass-bulb sprinkler.

_____ Supplied water flows out and hits the deflector.

_____ Heat makes the liquid in the bulb expand.

_____ The bulb breaks and releases the seal.

3 Apply what you learned

There are three sprinklers: A, B, and C. Only A becomes hot enough to activate. B and C stay cool, even though smoke is present. Which head opens, and why?

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4 Explain the demonstration

Why can this kit spray without heat? Use “no bulb,” “open outlet,” and “ball valve” in your explanation.

Check with your partner: Find the bulb and deflector on page 10. Name the different job each does. Teacher notes and sources: page 14.

Try a measurement

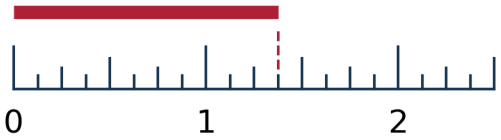
Name _____ Date _____

Start at zero. Each inch has eight equal spaces. Each small space is 1/8 inch.

Read together, and then try alone.

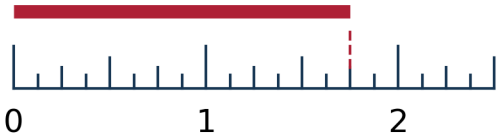
Read the red bar from zero to its right end. Write the length in inches. Your teacher will guide you through A; try B on your own.

A



Length A _____ in.

B



Length B _____ in.

Measure one shared pipe section.

A helper measures a separate loose pipe section from ruler zero. Record the teacher-checked reading. Never pull a glued section out of the base. If no loose section is available, complete the printed rulers only.

The pipe section measures _____ inches.

Check with a partner.

Point to the zero mark and explain how you counted the eighth-inch spaces. Correct your answer if needed.

Sprinkler fitters use careful measurements when working with pipe.

PRINT CHECK: The distance from 0 to 2 on either ruler must measure exactly two inches. Print at 100% or actual size and verify before copying.

STUDENT ACTIVITY 4 OF 4

Explore a fire sprinkler career

Name _____ Date _____

Use the Become a Life-Saver presentation and the roles below to explore careers. Think about what you enjoyed during the kit activities. Which role interests you? [2]

If you enjoyed	Explore this role	A task in this role
Working with parts and tools	Sprinkler fitter	Installs sprinkler piping and components.
Following drawings and planning	Sprinkler designer	Prepares system layouts and drawings.
Checking details and finding problems	Inspection and service technician	Checks systems and helps address problems.
Organizing people and materials	Project coordinator	Helps coordinate schedules and materials.

Choose one role.

Which role would you like to explore, and why?

Ask a question.

What would you ask someone who does this job? You might ask about a typical day, training, or how they got started.

Share and finish

Tell a partner which role you chose. Then name one kit part and explain its purpose.

For further research, visit firesprinklerjobs.org to learn more about fire sprinkler careers and training opportunities.

Teach the head and bulb activity

Use student pages 10–11 for about 10 minutes within the 25-minute Explore and demonstrate block. Spend 4 minutes on the picture and worked example, then 6 minutes on practice and feedback. Allow about 15 minutes for kit exploration and demonstration. No extra kit or intact sprinkler is required.

Guide the observation

Use the supplied illustration on page 10 to introduce the visible parts: red glass bulb, top deflector, brass frame, and threaded pipe connection. Explain the hidden seal separately; students cannot see inside the inlet in this image. Model pointing to the deflector and naming its job. Then students point to the bulb and describe its job. With the kit disconnected and drained, compare the missing bulb with the picture. [4]

For this lesson, describe a typical automatic glass-bulb sprinkler. Heat activates sprinklers individually; smoke alone does not open them. Other sprinkler designs and system types exist, including sprinklers with heat-sensitive metal links. Avoid suggesting that every sprinkler has a bulb or that all heads activate together. [1, 5]

The kit is deliberately open and has no bulb. Do not describe its ball valve as a heat detector or the spray demonstration as a test of fire protection performance. Never remove a bulb from an installed sprinkler to make a demonstration head. Do not use flame, heat, or broken glass in this activity.

Suggested answers

Compare: The first row is modeled: bulb present in the typical glass-bulb sprinkler; absent in the demonstration head. Before discharge, the typical head is closed and the kit head is open. Heat breaks the bulb and releases the seal in the automatic head; supplied water and an open ball valve allow the kit to discharge.

Sequence: Heat expands the bulb liquid = 1; bulb breaks and seal releases = 2; supplied water strikes the deflector = 3. The printed order is 3, 1, 2. Scenario: Head A opens; B and C remain closed because they have not been heated enough. Smoke alone does not open them.

Kit explanation: It has no bulb and its outlet is already open. With water supplied, opening the ball valve lets water reach the head without heat.

Picture check: The red tube is the bulb; it helps hold the seal closed until enough heat activates the sprinkler. The top plate is the deflector; it helps spread the water. The red liquid inside the bulb is not the firefighting water; water arrives through the pipe connection.

Check for understanding

Listen for four ideas: heat rather than smoke; bulb holds the seal closed; sprinklers activate individually; the open kit head needs no heat. If a student confuses the bulb with the deflector, have the student name each job again. Accept a spoken response or a labeled sketch.

Background sources

[4] Globe/Victaulic, GFS-205, Description and Operation. Used for bulb operation only; product ratings do not apply to this kit. View source

[5] U.S. Fire Administration, Home Fire Sprinklers. View source

See source [1] on page 4 for additional introductory background.