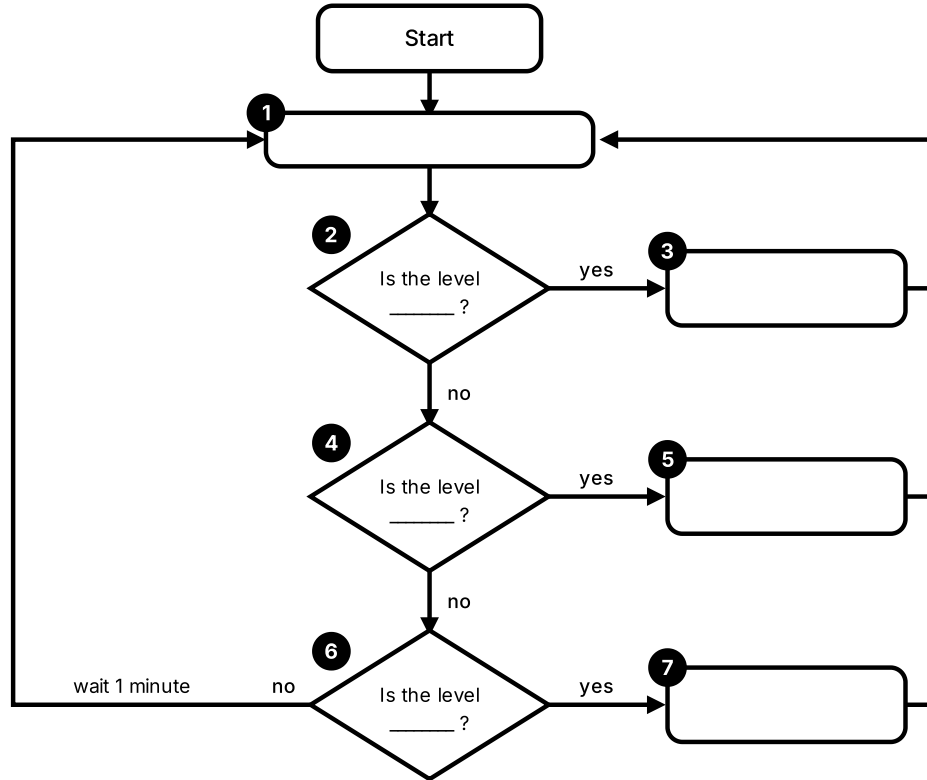




Smart Water Tank Controller

A water tower refills automatically. The pump turns on below 40% full and off above 90%. An alarm sounds above 95%. Complete the flowchart.

Name _____ Date _____



Word bank Read tank level sensor Turn pump ON Turn pump OFF Send alarm to operator
above 95%? below 40%? above 90%?

System part	In this controller
Input	
Process	
Output	
Feedback	

1. Why does the pump turn off at 90% instead of right at 40%? What would happen if the on and off points were the same?



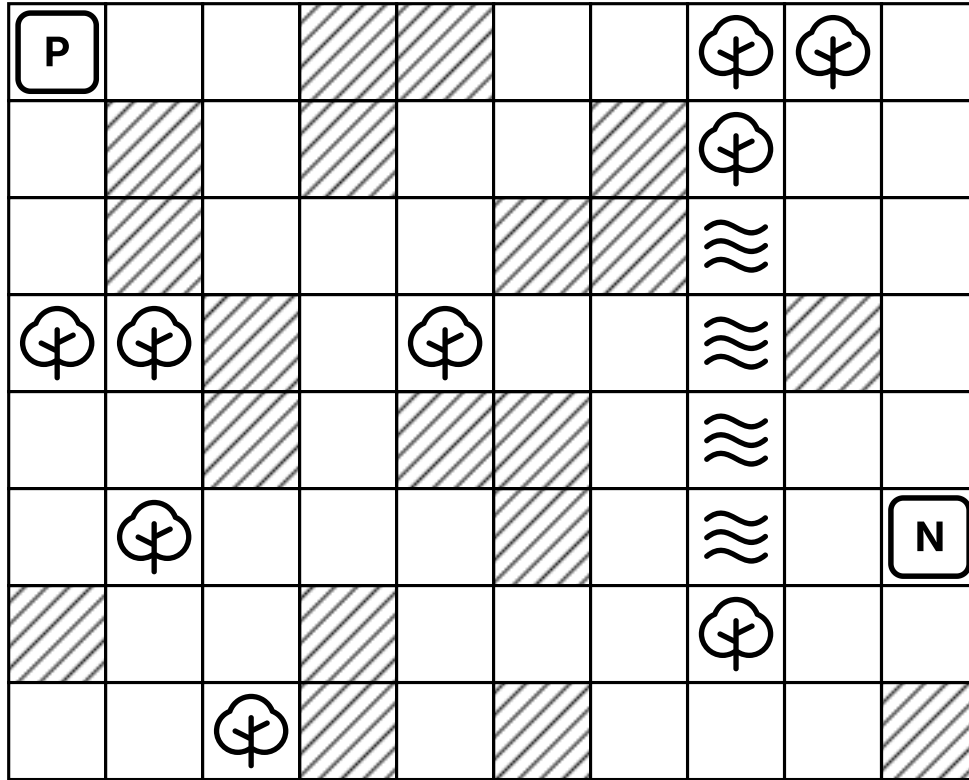
Grade 8

Pipe Route Challenge

Grade 8

Engineers must connect the pump station (P) to a new neighborhood (N). Find the route with the lowest total cost. Pipes run up, down, left, or right.

Name _____ Date _____



- Street: 1 point per square Park (dig up and replant): 3 points Creek crossing (bore under it): 5 points
 Building: pipe cannot pass **P** pump station **N** new neighborhood

Route	Squares crossed (street / park / creek)	Total cost
1st try		
2nd try		
Best		

1. Besides cost, what else should engineers think about when choosing a route? Name two factors.

2. The cheapest route crosses no creek. When might an engineer choose to cross the creek anyway?



Grades 8–12

Water Careers Bingo

Grade 8+

Listen to each job description. Mark the career that matches. Five in a row wins.

Card 1

W	A	T	E	R
Customer Service Representative	Backflow Inspector	Meter Technician	Instrumentation Technician	Safety Specialist
Water Quality Chemist	Electrical Engineer	Environmental Educator	Surveyor	Heavy Equipment Operator
SCADA Technician	Electrician	 Free space	Cybersecurity Specialist	Treatment Plant Operator
Hydrologist	Project Manager	Mechanical Engineer	Distribution Crew Member	Engineering Technician
Lab Technician	Data Analyst	Civil Engineer	GIS Analyst	Microbiologist

Cut along the dashed line.

Card 2

W	A	T	E	R
Civil Engineer	Engineering Technician	Electrician	Data Analyst	Treatment Plant Operator
Public Information Officer	Environmental Engineer	Hydrologist	Lab Technician	Cybersecurity Specialist
Surveyor	Customer Service Representative	 Free space	Distribution Crew Member	Machinist
Instrumentation Technician	Heavy Equipment Operator	Safety Specialist	Backflow Inspector	Mechanical Engineer
GIS Analyst	SCADA Technician	Project Manager	Electrical Engineer	Meter Technician



Grades 8–12

Water Careers Bingo

Grade 8+

Listen to each job description. Mark the career that matches. Five in a row wins.

Card 3

W	A	T	E	R
Mechanical Engineer	Leak Detection Technician	Safety Specialist	Public Information Officer	Water Quality Chemist
Electrical Engineer	Distribution Crew Member	Instrumentation Technician	SCADA Technician	Lab Technician
Environmental Educator	Customer Service Representative	 Free space	Heavy Equipment Operator	Civil Engineer
Cybersecurity Specialist	GIS Analyst	Project Manager	Treatment Plant Operator	Microbiologist
Backflow Inspector	Engineering Technician	Data Analyst	Surveyor	Meter Technician

Cut along the dashed line.

Card 4

W	A	T	E	R
Mechanical Engineer	Lab Technician	Meter Technician	Environmental Educator	Cybersecurity Specialist
Machinist	Electrician	Instrumentation Technician	Safety Specialist	Surveyor
Project Manager	Electrical Engineer	 Free space	Heavy Equipment Operator	GIS Analyst
Leak Detection Technician	Water Quality Chemist	Backflow Inspector	Public Information Officer	Treatment Plant Operator
Engineering Technician	Microbiologist	Environmental Engineer	Data Analyst	Distribution Crew Member



Grades 8–12

Water Careers Bingo: Caller List

Grade 8+

Read the description only. Check it off after you call it. Players must match the description to the career.

- ☐ **Treatment Plant Operator.** Runs the equipment that cleans river water around the clock
- ☐ **Water Quality Chemist.** Tests samples to measure things like chlorine and pH
- ☐ **Microbiologist.** Checks water for bacteria too small to see
- ☐ **Civil Engineer.** Designs water mains, reservoirs, and pump stations
- ☐ **Environmental Engineer.** Plans ways to protect rivers and meet clean-water rules
- ☐ **Electrical Engineer.** Designs power systems for huge pumps and motors
- ☐ **Mechanical Engineer.** Keeps pumps, valves, and machines running efficiently
- ☐ **Hydrologist.** Studies how water moves through rivers and underground
- ☐ **GIS Analyst.** Makes digital maps of every pipe and valve in the city
- ☐ **SCADA Technician.** Maintains the computer system that monitors the plant remotely
- ☐ **Instrumentation Technician.** Calibrates sensors that measure flow, pressure, and levels
- ☐ **Meter Technician.** Installs and repairs the meters that measure water use
- ☐ **Distribution Crew Member.** Repairs water main breaks, even on the coldest winter nights
- ☐ **Heavy Equipment Operator.** Runs backhoes and excavators to reach buried pipes
- ☐ **Lab Technician.** Collects and prepares water samples for testing
- ☐ **Data Analyst.** Finds patterns in water use and plant data
- ☐ **Cybersecurity Specialist.** Protects control systems from hackers
- ☐ **Electrician.** Wires and repairs motors, control panels, and lighting
- ☐ **Machinist.** Makes and repairs metal parts for pumps and valves
- ☐ **Surveyor.** Measures land to find exactly where pipes should go
- ☐ **Engineering Technician.** Creates drawings and plans with CAD software
- ☐ **Project Manager.** Keeps construction projects on schedule and on budget
- ☐ **Safety Specialist.** Trains workers to stay safe around chemicals and machinery
- ☐ **Customer Service Representative.** Helps residents with questions about service and bills
- ☐ **Public Information Officer.** Shares water news and advisories with the public
- ☐ **Leak Detection Technician.** Listens for hidden leaks with sensitive microphones
- ☐ **Backflow Inspector.** Makes sure used water can't flow back into clean pipes
- ☐ **Environmental Educator.** Teaches students and neighbors about protecting water

Make more cards by shuffling any 24 careers from this list into a 5 × 5 grid with a free center square.

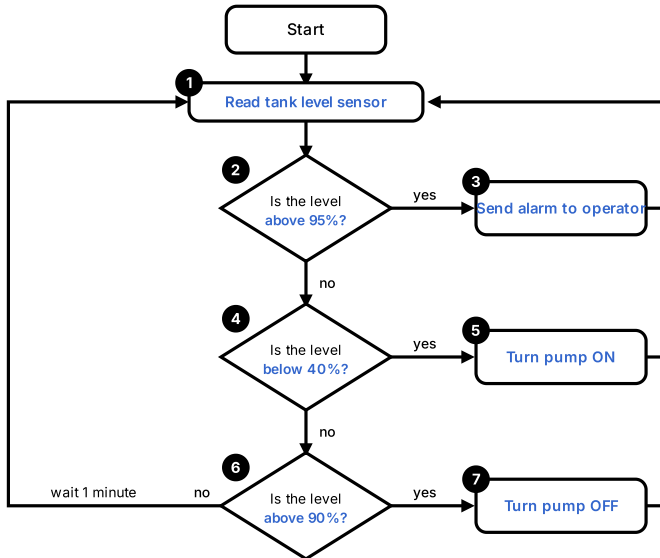


For teachers

Grade 8 Answer Key

Accept reasonable answers that are supported by evidence.

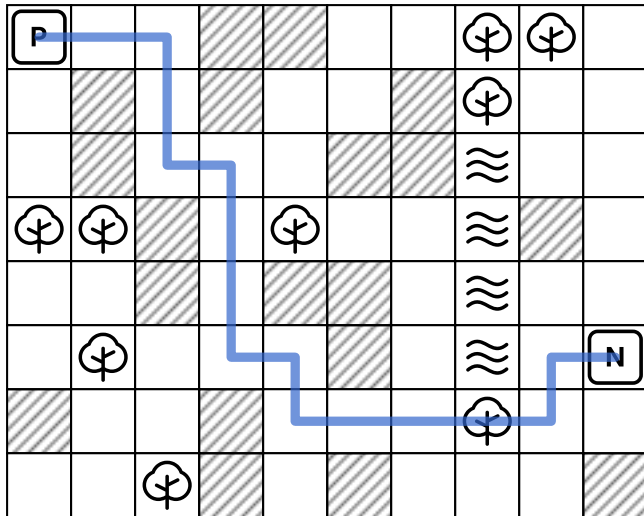
Smart Water Tank Controller



Input: tank level sensor reading. Process: controller compares the level to set points. Output: pump motor on or off, alarm. Feedback: the new tank level is measured again.

The gap between 40% and 90% keeps the pump from switching on and off constantly, which would wear out the motor and waste energy.

Pipe Route Challenge



Lowest total cost: **18 points** (15 street, 1 park, 0 creek squares). Other routes with the same total are also correct.