

Puddle Problem Solvers

Plan different kinds of investigations before designing a solution.

7.1.B “use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;”

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Write a 1 beside the descriptive-investigation plan, a 2 beside the comparative-investigation plan, a 3 beside the experimental-investigation plan, and a 4 beside the engineering-design plan. Circle details that show what is observed, compared, changed, or designed.

Tracking a Muddy Courtyard

- ① At Creekside Middle School, students noticed that one corner of the courtyard stayed muddy after rain. Before changing anything, Maya's team planned a descriptive investigation. For five school days, they would visit at the same time, sketch where puddles appeared, measure each puddle's width, and record the weather. They would not compare groups or change a condition. Their observations could show when and where water collected. This evidence would help them identify the problem accurately.
- ② Next, the team planned a comparative investigation to learn whether the muddy corner differed from a dry corner. They would measure soil moisture in both corners after the same rainstorms, using the same meter and sampling time. For a separate experimental investigation, they would test one possible cause. They would place identical trays of soil under a downspout or away from it, add the same amount of water, and measure water left after ten minutes. Keeping soil, tray size, water, and time the same makes location the only changed factor.
- ③ After gathering evidence, the students could use an engineering design process to reduce puddles. They first would state the problem and list criteria, such as moving water away from the walkway. They also would name constraints: the project must fit in the corner, cost less than \$150, and use materials the school can obtain. The team might sketch a gravel channel, build a small model, test how quickly it drains water, then revise the design if it fails a criterion.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What would the team record during its descriptive investigation, and what two actions would it avoid?

2 What makes the soil-moisture study a comparative investigation?

3 In the tray experiment, what factor changes? Name two factors kept the same.

4 Name one criterion and two constraints for the proposed puddle solution.

3 YOUR TURN _____ Your own words

Choose a school problem involving water, waste, light, or noise. In 5 to 7 sentences, plan a descriptive investigation, a comparative investigation, and an experimental investigation, then describe an engineering solution with one criterion, one constraint, and a test-and-revise step.

[illegible]

PART 1 • READ AND MARK

Write a 1 beside the descriptive-investigation plan, a 2 beside the comparative-investigation plan, a 3 beside the experimental-investigation plan, and a 4 beside the engineering-design plan. Circle details that show what is observed, compared, changed, or designed. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What would the team record during its descriptive investigation, and what two actions would it avoid?	They would sketch puddle locations, measure puddle width, and record weather. They would not compare groups or change a condition.
2	What makes the soil-moisture study a comparative investigation?	It compares soil moisture in two different courtyard corners after the same rainstorms, using the same meter and sampling time.
3	In the tray experiment, what factor changes? Name two factors kept the same.	The tray location, under or away from the downspout, changes. Soil, tray size, amount of water, and time are kept the same.
4	Name one criterion and two constraints for the proposed puddle solution.	A criterion is moving water away from the walkway. Constraints include fitting in the corner, costing less than \$150, and using materials the school can obtain.

PART 3 • YOUR TURN (SAMPLE ANSWER)

I would investigate noise near the library door. First, I would record the times and locations of loud sounds for three days without changing anything. Next, I would compare average sound levels during passing periods and class periods with the same sound meter. Then, I would experimentally test a rubber door bumper by measuring ten door closings with the bumper and ten without it from the same location. I would design a padded door-stop system that lowers sound by at least 10 decibels and costs less than \$40. I would test the system for a week and revise it if the sound level does not meet the criterion.

Accept equivalent descriptions that clearly separate observing without changes, comparing groups or conditions, and changing one factor while holding other factors constant. For Part 3, accept varied school problems and solutions when the investigation types, criterion, constraint, and revision plan are all clear.