

# Pennsylvania Grade 3 to Grade 4 Engineering Design Summer Bridge Workbook

*Engineering Design: Review, Readiness, and Practice*

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# Welcome to Engineering Design

## Summer Bridge Workbook



A practice notebook for growing from Grade 3 design skills into Grade 4 readiness.

This bridge workbook gives students space to practice and stretch. It begins with Grade 3 engineering design review, then adds readiness work where students explain decisions more clearly and use evidence more carefully.

### ✔ Review and practice

- name the problem before the solution
- mark criteria and constraints
- compare choices fairly
- read test data closely
- write short improvement reasons

### → Readiness habits

- make notebook-style observations
- connect research to brainstorm
- defend choices with evidence
- keep test variables controlled
- plan the next version of a design

#### Use the page like a designer's notebook

Students should mark clues, try every question, and correct with evidence. A good engineering answer does not need to be long; it needs to match the problem, the criteria, the constraints, or the test results.

# How to Use Engineering Design

## Summer Bridge Workbook



Use each page to practice a small design move.

This workbook mixes review with readiness. Students practice Grade 3 engineering design and then try Grade 4-style thinking in small steps: clearer problem statements, better evidence, fairer tests, and stronger improvement plans.

- Daily work** Complete one page. Read the problem carefully, mark the important design clue, and answer before checking.
- Mixed review** Use the weekly page to switch between review and readiness. Students may define, compare, test, and improve on the same page.
- Best pace** Plan for about 15–20 minutes. Extra time should go to explaining the reason, not doing more pages.
- After checking** Correct missed answers and write one quick note: problem, rule, test, or fix. That note names what to remember.

### Notice

Mark what matters in the problem, picture, decision table, or test data.

### Use

Use the design process: define, brainstorm, compare, test, and improve.

### Grow

Add one Grade 4 readiness habit, such as stronger evidence or a clearer next step.

### For students

Use small notes and marks. If you change an answer after checking, write why. That is how designers improve a first idea.

### For parents and teachers

Ask for one sentence of evidence: “I chose this because...” Keep the focus on design reasoning, not on memorizing a long explanation.



# My Bridge Workbook Progress

Track review lessons, readiness lessons, and each Friday mixed-review score.

5 review weeks

3 readiness weeks

8 Friday reviews

This grade 3 to grade 4 science summer bridge workbook belongs to:

Week	Focus	Mon	Tue	Wed	Thu	Friday Review
1	Defining Design Problems and Comparing Solutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
2	Comparing Solutions and Testing and Improving Mix	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
3	Defining Design Problems and Comparing Solutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
4	Testing and Improving and Defining Design Problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
5	Defining Design Problems and Comparing Solutions Mix	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
6	Grade 3 Review and Grade 4 Preview	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
7	Grade 4 Preview: Generating and Comparing Solutions and Fair Tests and Failure Points	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10
8	Grade 4 Preview: Defining Design Problems and Generating and Comparing Solutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> / 10

 **Reflection Notes**

A design idea that feels strong: \_\_\_\_\_

A design idea to practice again: \_\_\_\_\_



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*Let's learn and have fun!*



WEEK

1

## *Defining Design Problems and Comparing Solutions*

*Practice this week's science ideas.*

### *This Week's Days*

- Day 1*      *Problems, Needs, and Wants*
- Day 2*      *Criteria and Constraints*
- Day 3*      *Define Your Own Problem*
- Day 4*      *More Than One Way*
- Day 5*      *Week 1 Mixed Review*

# Answer Key & Explanations

Check the answer first, then read the explanation to see the evidence or reasoning.

## Week 1 Day 1: Problems, Needs, and Wants

### Answers

1

B

2

A

3

C

4

True

5

False

6

True

7

problem

8

need

9

solutions

10

yes

11

See Explanation

12

See Explanation

### Explanations

1

The problem names the need, crossing safely, before choosing a bridge as the solution.

2

Changing from paper maps to phone maps shows that people improve technology as needs change.

3

A solution is the object, tool, process, or system designed to solve the problem.

4

Engineers often begin by asking what people need or want to improve.

5

A bridge is already one possible solution; the problem is that people need to cross safely.

6

Engineering solutions can be many kinds of designs, not only objects.

7

A problem is the need or want that starts engineering work.

8

Keeping dry can be stated as the need before choosing an umbrella or roof design.

9

Solutions are the designs engineers create after the problem is clear.

10

The example shows a newer solution replacing an older one.

11

It names a solution too early. A stronger problem statement says that people need to cross the stream safely.

12

A good problem statement names the need, such as students need a way to carry books safely without dropping them.



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### Week 1 Day 2: Criteria and Constraints

#### Answers

- 1 A    2 C    3 A    4 True    5 False    6 True    7 criteria  
 8 constraints    9 time    10 yes    11 See Explanation    12 See Explanation

#### Explanations

- 1 A criterion tells what success looks like, such as holding five books.
- 2 Using only classroom materials is a limit on how the design can be made.
- 3 Testable criteria let engineers decide whether a solution really met the goal.
- 4 Those limits affect what solutions are possible.
- 5 Criteria should describe success that can be checked, not a preference by itself.
- 6 Using the same success rules makes the comparison fair.
- 7 Criteria describe what the finished solution must do.
- 8 Constraints are the limits engineers must work within.
- 9 Time is a common limit, along with materials and cost.
- 10 Checkable criteria help people judge whether the design worked.
- 11 Both parts are criteria because they state what the successful feeder must do.
- 12 A materials limit is a constraint, so the team must choose designs that can be made with those materials.

### Week 1 Day 3: Define Your Own Problem

#### Answers

- 1 B    2 A    3 B    4 True    5 False    6 True    7 user    8 criteria



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9 constraints

10 yes

11 See Explanation

12 See Explanation

### Explanations

- 1 It names the need and includes a constraint, so a team could start designing.
- 2 The user is the person or group that has the need.
- 3 Criteria and constraints tell the team what success means and what limits apply.
- 4 Many design problems need several success rules.
- 5 Teams need to know constraints so they can design within the limits.
- 6 Clear problem statements give enough information for others to begin designing.
- 7 The user is the person or group the design is meant to help.
- 8 Criteria tell how the design will be judged, so they act as the success rules.
- 9 Constraints describe limits such as materials, time, or cost.
- 10 A design may need to meet more than one success rule.
- 11 It should include the user, the need or want, the criteria for success, and the constraints.
- 12 A partner can check whether the need, criteria, and constraints are clear enough to start designing.

### Week 1 Day 4: More Than One Way

#### Answers

1 A

2 A

3 A

4 True

5 False

6 True

7 research

8 brainstorm

9 sketch

10 peers

11 See Explanation

12 See Explanation

#### Explanations



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