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Cover Page

Invention Name:
Let the students come up with a fun and creative name that describes their group's invention. They should write it here on the cover page and use it in their presentation.

While it might be tempting to name the invention early on, the students should wait until the end of the project when they know more about it.
We recommend naming the invention during the Communicate step.

Invention Category:
The students will choose the invention category that best describes their invention and write it here on the cover page.
See the Invention Categories handout for more information.

If you decide to use composition notebooks or other blank notebooks instead of the provided Logbook, include the information from this page on the cover or first page of the notebook.

Problem (continued)

Define the Problem: After the students choose a problem, they need to write down everything they know about it.

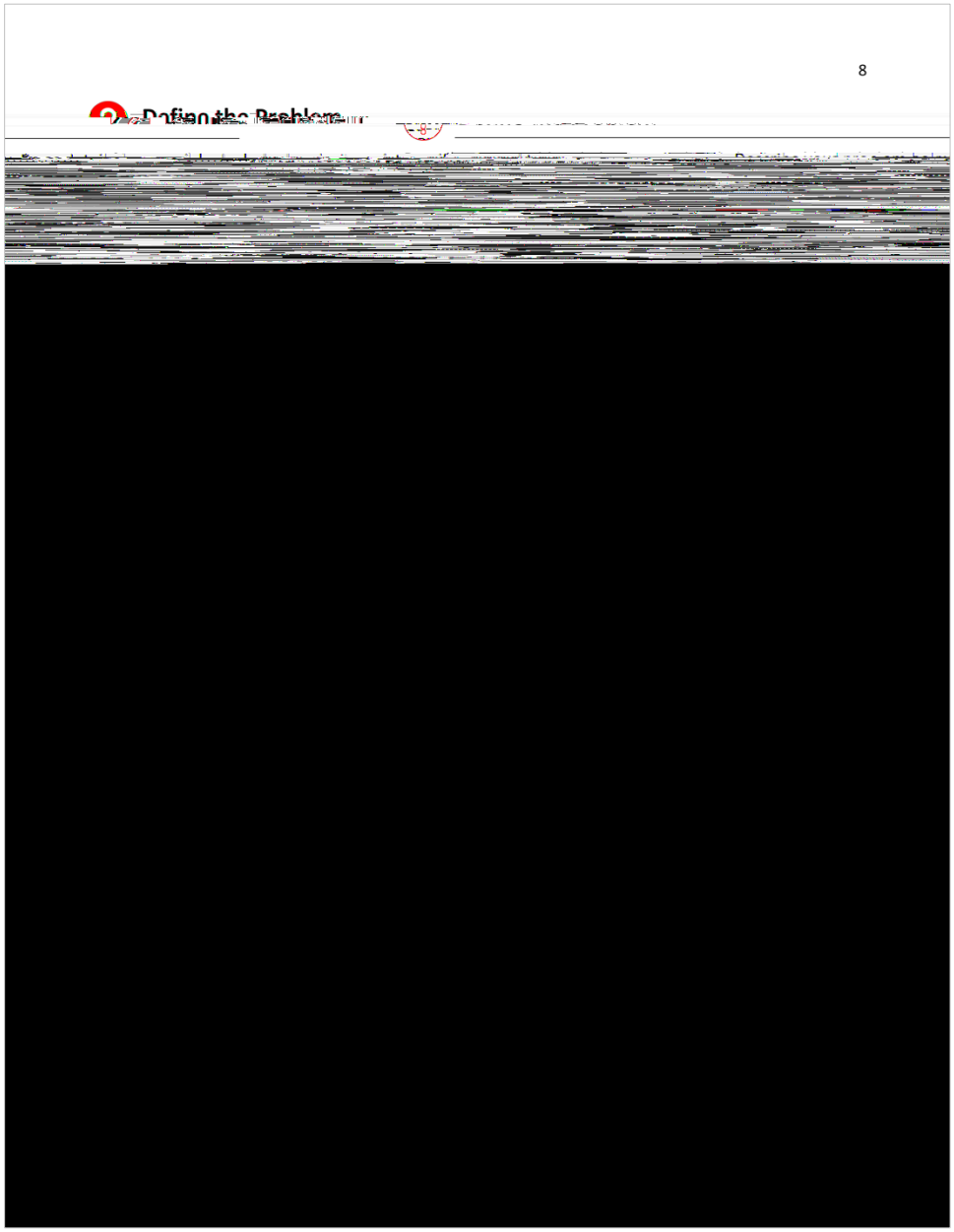
Read the example from the previous page ósstudent editionô and practice defining the problem together on the board.

Think about what the problem is, where it is, what needs to be fixed, why it is important, etc.

Imagine you are describing the problem to someone who has no knowledge about it. What information do they need to know?

After completing the example, let each group discuss their problem and describe it in the Logbook. The more details the better.

In addition to the written description, students are welcome to draw a picture or take a photo to further explain things.



Notice that this step is different from the upcoming Requirements step. The requirements describe the *solution*, while this step describes the *problem*.

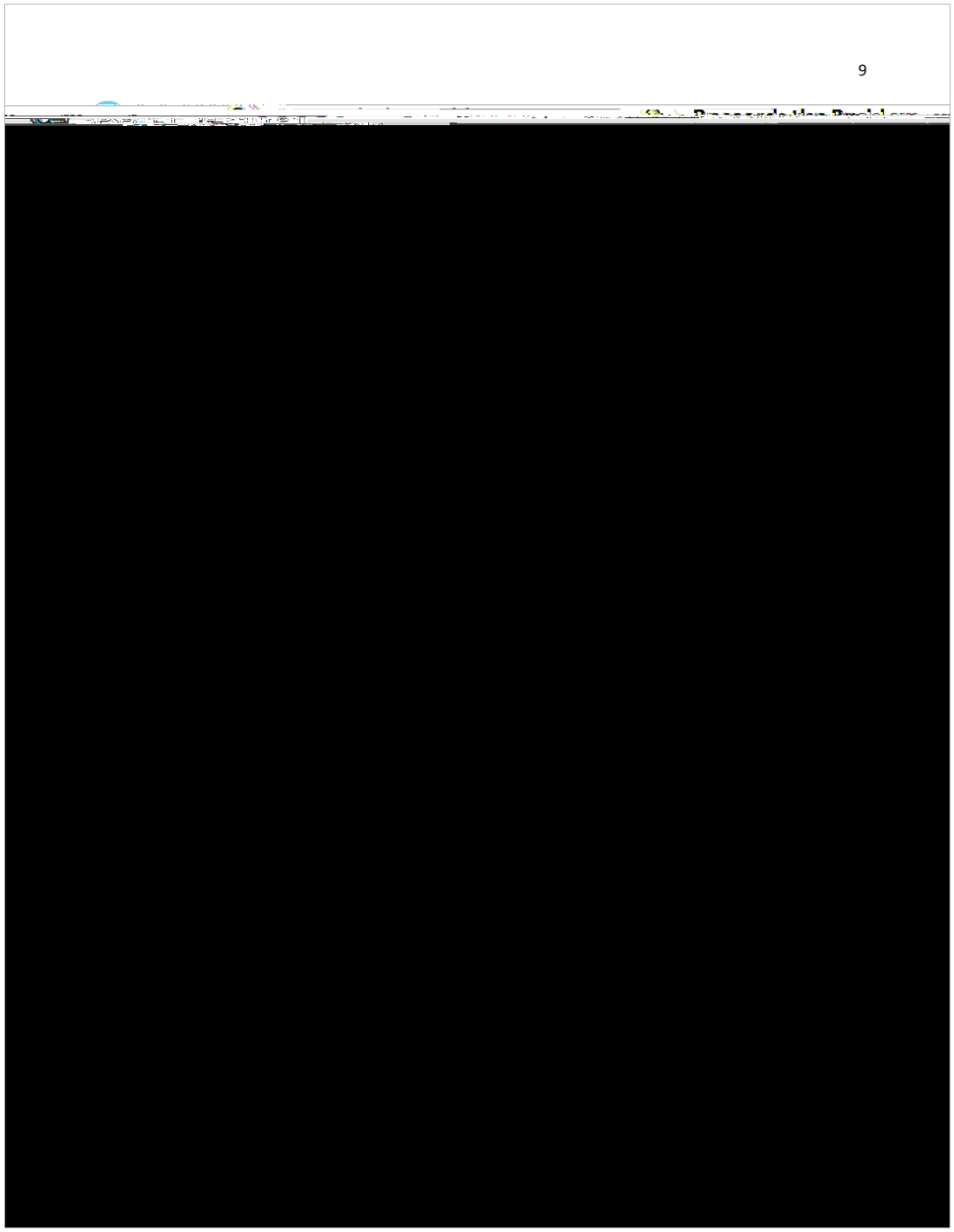
It is important to understand the problem before considering solutions. This will make the following steps

Research

Let students work in their groups to research the problem. The provided questions will guide their search but they are welcome to look beyond the prompts to learn more.

Ask them to use books, websites, videos, surveys, interviews, etc. to find the relevant information.
If they are not already familiar with this type of research, you may need to give additional instructions.

They should also cite where they found the information. Each question will be followed by a brief citation and will correspond to a detailed citation at the end of the Logbook. You can choose how they format these and what details to include. Print additional source pages as needed.



Requirements

Requirements are important. They tell you what the solution needs to do, help you choose the best solution, and let you test how well it works.

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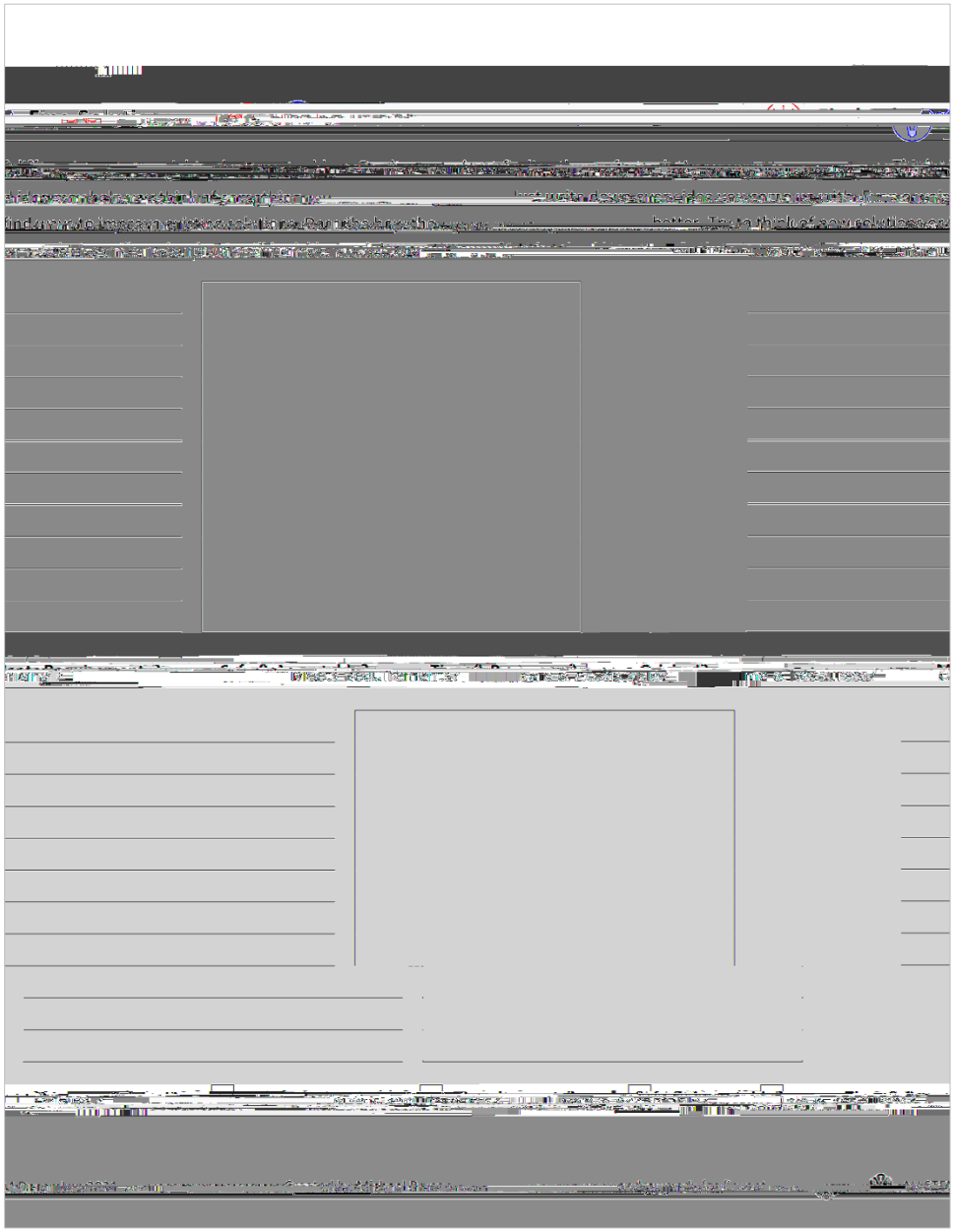
Solution

Find Solutions: Brainstorming solutions is a fun activity. You can really let your imagination go and think of any and every solution that comes to mind. There are no bad ideas at this point, because even a weird idea might inspire something great.

Let the students talk in their groups and think up as many solutions as they can. Ideally, these should be things they can build, and they should be new óoriginalú ideas.

Have them draw the ideas in their Logbook and write a brief description for each. The ¤ checkboxes are for later.

The Logbook provides space for two solutions, but students should think of more than that. Print extra solution pages for each group and add them to the Logbook as needed.



Solution (continued)

Compare Ideas:
The students will narrow their list by answering questions for each idea. If they answer yes to a question, they should check the corresponding box.

For example, if one of the solutions meets all their requirements, they will check the box for ǿMeets Requirementsȅ.

Question 4: Originality
Read the example and talk about why originality is important. If someone had the idea first, it is too late for you to *invent* it, but you might be able to do it differently or better ǿinnovationǔ.

Researching originality can be time consuming, so it should only be done for ideas that pass questions ɯ-o. Even then, the research does not need to be comprehensive until a solution is chosen. A brief web search usually gives a reasonable answer. This will be followed up in more detail for the solution they choose ǿnext pageǔ.

Choose the Best Solution:
After answering the questions for each solution, the group should choose the idea that answered yes to all ɲ questions, or if multiple solutions passed, they may need to just pick one or combine ideas.

If they came up with new solutions during this process, provide them with additional solution pages.

Originality

The students need to finish their originality research for the solution they chose. Ideally, their solution will be completely original, but if not, they need to make it

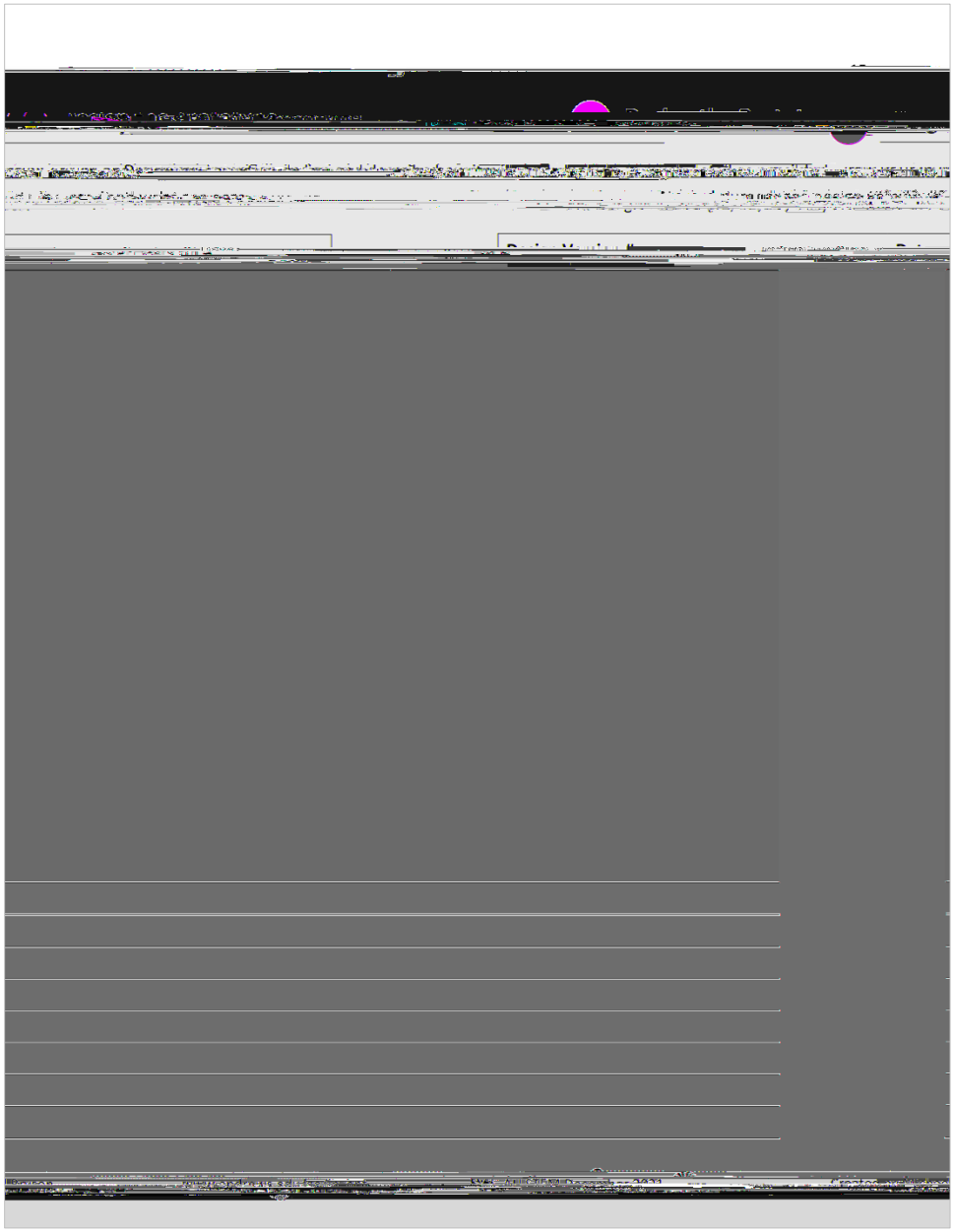
Design the Prototype

Design:
Before building the prototype, a design must be drawn up based on the chosen solution. This is a detailed plan showing how the invention will work, what it will look like, materials to be used, etc.

Students will work in their groups to do the following:

- Discuss and plan
- Draw their design
- Describe the design
- Write the Version I and Date at the top óVersion I will be M until they revise itú

Hands-on Design:
Students may benefit from experimenting as they plan. Trying things as you go is a good way to visualize the design and solve the problem faster.



Revision:
After the students have built and tested the prototype, they may need to come back and revise their design. If they update the design, print a new copy of the design pages, and increase the version number óIH, Io, etc.ú.

Build the Prototype

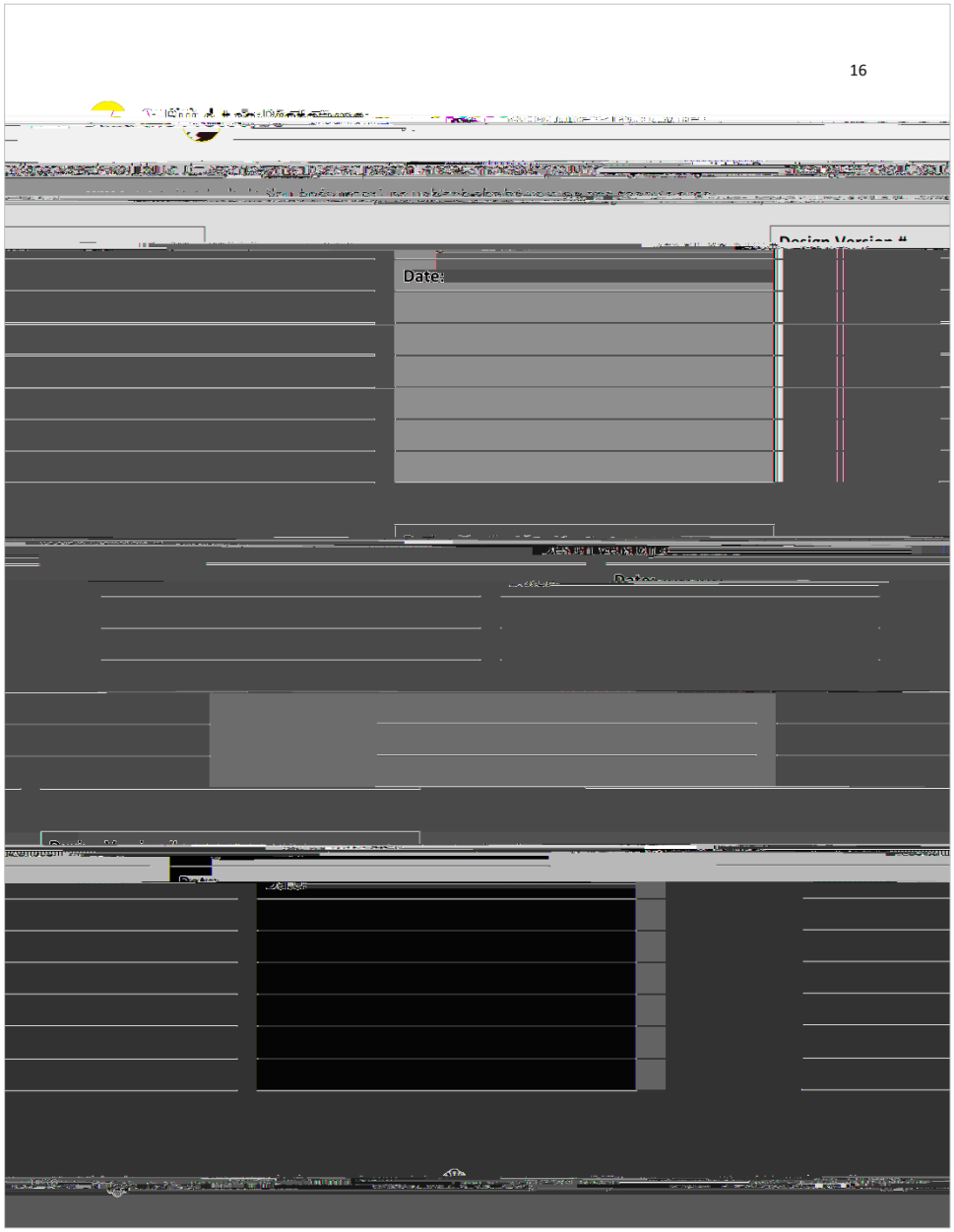
After drawing their design, the students will work with their team to build the prototype.

Provide them with inexpensive materials such as cardboard, paper, tape, glue, etc. óraid the recycle bin or the craft closetú. If they want to use other materials, that's fine as long as they meet the Project Guidelines.

If their design calls for higher quality materials, they can still model it inexpensively. For example, a plastic box with metal hinges could be modeled using cardboard and tape.

The prototype is only a model of their design so it doesn't have to work perfectly. If they can make it functional that would be great, but even a static model can demonstrate how the invention works.

Challenge them to think outside the box and find creative solutions as they build their inventions.



Take Notes:
As the students work on their prototype, they should describe any challenges, decisions, etc. They will write the Version I for the design they are building and the current date. Print additional build pages as needed.

Test the Prototype (continued)

Fill in the Design Version I and Date at the top of each testing page to keep track

Conclusion

At the end of the project, each group will fill out the conclusion page to summarize what they did.

In the first section, the students will summarize their work.

The Biblical Connection relates their project to a Bible story, character, spiritual lesson, or anything from the Bible that connects in some way.

For examples, see the Biblical Connection section in the Teacher Resources on our website.

Communicate

Name the Invention:
After the students have finished their prototype, they can choose a catchy name that describes their invention and write it on the cover.

Invention Category:
Help the students choose the appropriate invention category and write it on the cover below the name.
See the Invention Categories handout for more information.

Prepare to Present:
Each group will prepare a tri-fold presentation board and a verbal presentation about their project.

The tri-fold board will follow the engineering design process with one section for each step. The verbal presentation will cover the same material.
See the Presentation Guidelines handout for more information.