

Designing From Scratch

By ReadWorks



Open up a newspaper, click on a news website, or peel open the latest magazine. Chances are you'll find something about a new technology. You may read about the latest digital enhancements in smartphones, or maybe something about advancements in green technology—that is, how to reduce our environmental impact. Whatever that technology might be, it all started with an idea regarding engineering design.

Typically, the process of engineering design starts with a problem or a need. For example, let's consider the hypothetical building of a new apartment complex. Our task is to construct a green, sustainable city building. This will allow residents to easily commute to their workplace, hopefully without cars in order to cut back on air pollution. However, there are several considerations that need to be addressed. We must consider various things: potential energy sources, waste disposal, materials of the new building, and water sources. To make these decisions, it is best to define a precise task with criteria and constraints. What is the budget? What materials are available? If questions like these can be answered early on in the design process, it is more likely that the designed solution will be successful. Therefore, it's important to go through each consideration one by one to determine the best possible solution.

Building Materials

First, the question must be asked—are we building on an empty lot, or are we replacing an old building? If it's the latter option, we must face the decision of completely tearing down the old building, or utilizing the current space and renovating it for our design. As previously mentioned, our goal is to be sustainable, which means our building should be built using methods that do not completely use up or destroy natural resources. We want to have the minimum possible negative impact on the environment. To attain our goal, we could demolish the old building in order to use new, sustainable technology; however, we would have to purchase new building material, which isn't necessarily sustainable, since we're not recycling. Or we can use the skeleton of the old building, but this may limit our use of modern technology. Unfortunately, there are tough decisions to make during the design process—sometimes there isn't one option that is clearly the best. Therefore, it's important to weigh the good against the bad, and move on from there.

Energy Sources

Since the task is to build a sustainable building, we should consider sustainable energy sources. It might be easier to use non-renewable energy (which is considered less sustainable than renewable energy), because it's often more readily available. However, our task is to create a sustainable building, so we need to find sustainable energy sources. Solar panels could be an option, if we are building in a sunny area. Another option might be wind energy, generated by large wind turbines. Furthermore, it is important to think not only about generating energy, but about saving that energy. Insulation is an important factor to consider, as it helps keep the heat in during the winter and makes sure the building doesn't get too hot in the summer.

Waste Disposal

Because our goal for the building is sustainability, a baseline requirement for tenants of the building should be recycling and composting. For this reason, it is important to provide recycling and composting services to the building.

Water Sources

Imagine we are building in an area known for having a high amount of rainfall. Since the city is covered with streets and buildings, the rain isn't absorbed by the ground. This may lead to flooding. When planning our building, it is vital to try to prevent flooding by absorbing storm water runoff. Possible solutions include roof gardens, rain gardens (gardens planted in a lowered hole to soak up excess water), and flow-through planters (which temporarily relieve water runoff). All three of these solutions can be implemented in the building. As long as they are properly maintained, the gardens can greatly contribute to reducing flooding after large rainfalls.

The Solution

From this example, we can see how many decisions are involved in the design process. And these aren't even all of them! There are many, many more decisions involved in the construction of a new building. However, the design process is made much easier by setting specific tasks and defining constraints. This way, you can focus on providing the best possible solutions.

Name: _____ Date: _____

1. The process of engineering design typically starts with what?

- A a detailed plan
- B a set of criteria
- C a need or a problem
- D building materials

2. What is a solution provided for the problem of flooding in cities?

- A rain gardens
- B solar panels
- C wind turbines
- D recycling services

3. Read the following sentences: "We must consider various things: potential energy sources, waste disposal, materials of the new building, and water sources. To make these decisions, it is best to define a precise task with criteria and constraints." Based on this evidence, what conclusion can be made?

- A A successful design does not require strategy or forethought.
- B The most important consideration when designing a building is energy source.
- C Criteria and constraints will hold you back in the design process.
- D Designing something requires a logical, planned approach.

4. What is an example of renewable energy?

- A gas
- B wind
- C oil
- D coal

5. What is this passage mostly about?

- A things to consider when designing a sustainable building
- B sustainability and the green technology movement
- C how the process of engineering design starts and ends
- D ways to improve and speed up the design process

6. Read the following sentences: "First, the question must be asked—are we building on an empty lot, or are we replacing an old building? If it's the **latter**, we must face the decision of completely tearing down the old building, or utilizing the current space and renovating it for our design."

What does "**latter**" mean as used in this sentence?

- A a hard decision
- B a new building
- C first of two things
- D second of two things

7. Choose the answer that best completes the sentence below.

There are many things to consider when designing a building, _____ energy sources, water sources, and building materials.

- A ultimately
- B on the contrary
- C including
- D therefore

8. What does "sustainable" mean?

9. Compare the advantages and disadvantages of demolishing an old building versus renovating it.

10. How would you design the most sustainable apartment building? Support your answer using information from the passage.
