

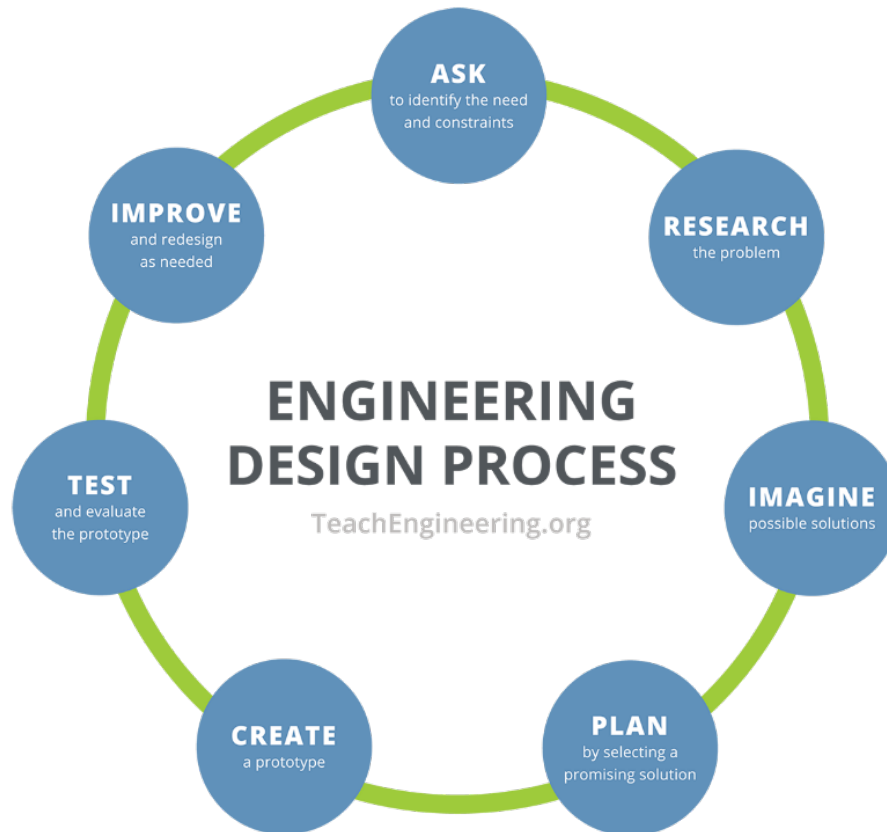
Name:

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Engineering Design Process Worksheet – Answer Key

Instructions: In this worksheet, you will use the steps of the engineering design process to ask, research, imagine, plan, create, test, and improve activities that potentially will lower heart rate during a simulated panic attack. You will need to identify one activity that can be done at home, one done at work or school and one activity with no accessories. Good luck!



Step 1: Ask

1. What problem are you trying to solve?

What ideas or activities can be used to successfully counter panic attacks?

2. What are the constraints of the problem?

Activities chosen must include one that can be done at home, one that can be done at work or school, and one that can be done without any accessories.

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Step 2: Research

3. Using your laptop, explore recommendations from popular online sources related to psychology, neuroscience, anxiety, and panic attacks.

Answers will vary.

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Step 3: Imagine

4. Based on your research, individually brainstorm 5-6 ideas or activities that could lower heart rate during a simulated panic attack.

a. <i>Answers will vary.</i>	b.
c.	d.
e.	f.

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Step 4: Plan

5. With your partner, choose three ideas/activities you will test, one for each scenario. Fill out the information below to plan each activity.

Activity 1: Can be carried out within your home.

Activity to test: **Example: Snuggling with a blanket**

Do you need any items for this activity: **Example: Fuzzy blanket from home**

Justification: Why do you think this activity will mitigate a panic attack? **Example: This should counter the cold-water effects by warming me up. The fuzziness of the blanket should help me remain calm.**

Activity 2: Can be carried out at work or school.

Activity to test: **Example: Coding video game programming on the laptop**

Do you need any items for this activity: **Example: Laptop or computer**

Justification: Why do you think this activity will mitigate a panic attack? **Example: Coding helps me "get into the zone," which should put me in a calm and relaxing state of mind.**

Activity 3: Can be carried out in any setting with no accessories.

Activity to test: **Example: Singing my favorite song**

You may not use outside items for this activity. It must be a purely mental exercise and could even be done in the car.

Justification: Why do you think this activity will mitigate a panic attack? **Example: Singing my favorite song should distract my thoughts enough to put me in a different headspace during the panic attack, helping me focus on something else.**

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Steps 5/6: Create and Test

6. Before testing, copy over your data from the first day tests.

Average baseline heart rate (HR) for 5 minutes: _____

Average HR during simulated panic attack for 5 minutes: _____

HR during mammalian diving reflex (MDR) for _____ seconds: _____



How long did you hold your breath?

7. Repeat the steps to simulate a panic attack. During the simulated panic attack, have the Test Subject engage in the team's chosen activity or idea to STOP the panic attack. Have the Data Specialist record the average heartrate over 5 minutes and record below.

Activity	Average HR for 5 min
Snuggling with a blanket	
Coding on the laptop	
Singing my favorite song	

8. Which, if any, of the three activities was able to lower the test subject's heart rate during the simulated panic attack?

We found that the computer programming activity notably lowered the test subject's heartrate during SPA.

Step 7: Improve

9. If you could do this activity again, what would you do differently? What would you improve?

Answers will vary.

10. How would you change your chosen activities?

Answers will vary.

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Reflection Questions:

11. What did you think of this activity?

Answers will vary.

12. What surprised you in this activity?

Answers will vary.

13. Imagine you had a friend who confided in you that they have no idea how to manage their panic attacks and asks for your advice. What would you say?

Answers will vary.

Hopefully they will recommend one of their activities based on the data gathered, or suggest a modification to their activities if they did not work.

14. Real-world connection: Agoraphobia is commonly mistaken as the fear of going out into public, but more accurately it is the fear of experiencing anxiety and/or panic attacks in public. Consider how your activity can be carried out in this setting without drawing too much attention.

In real-world situations, people with agoraphobia are often more afraid of experiencing anxiety or panic attacks in public than of being in public itself. This fear can make it challenging for them to leave their homes or engage in normal activities. When designing an activity to counter panic attacks for someone with agoraphobia, it's important to consider how discreet it can be. The activity should be easy to perform in public without drawing unwanted attention. For example, deep breathing exercises, discreet muscle relaxation, or focusing techniques (such as using a calming object) could be effective methods that can be done without anyone noticing, helping the individual manage their symptoms quietly and confidently.

15. How does the mammalian diving reflex (MDR) lower heart rate?

MDR lowers heart rate through the activation of the parasympathetic nervous system when the face is submerged in water. This reflex is triggered by cold water touching the face, which signals the brain to conserve oxygen. In response, the vagus nerve is stimulated, slowing the heart rate (a process known as bradycardia). Additionally, blood is redirected away from non-essential areas such as the limbs and toward vital organs such as the brain and heart. This reduction in heart rate and redistribution of blood helps the body conserve oxygen, which is essential for survival underwater.

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16. What role does the vagus nerve (X) play in the MDR?

The vagus nerve (cranial nerve X) plays a crucial role in the MDR by activating the parasympathetic nervous system when the face is submerged in water. When triggered, the vagus nerve sends signals that slow the heart rate, reduce blood flow to non-essential organs, and conserve oxygen for vital organs like the brain and heart. This reflex helps the body conserve energy and oxygen, a survival mechanism seen in all mammals. The vagus nerve's role in the MDR is central to reducing heart rate, helping the body adapt to being underwater.

17. What must be true if I find that my activity lowers my heart rate during the simulated panic attack?

If your activity successfully lowers your heart rate during the simulated panic attack, it suggests that the activity may be triggering a parasympathetic nervous system response, which helps counter the fight-or-flight reaction of the sympathetic nervous system. This indicates that the activity has a calming effect, helping to reduce stress and promote relaxation by restoring balance between the two systems. The activity could potentially be an effective strategy for managing real-life panic attacks or stress responses.

18. How is your brain like a computer?

The brain is often compared to a computer because both process information in similar ways, though the brain is more complex. The brain receives inputs from the senses and internal signals, processes them through networks of neurons, and generates responses like thoughts or actions. Similarly, a computer takes inputs from devices like a keyboard or mouse, processes the data with hardware and software, and produces outputs on a screen or through sound. Despite the similarities, the brain's processing capabilities are far more advanced and adaptable than that of a computer.