WESTLAKE SCIENCE & ENGINEERING FAIR FAIR ENGINEERING PROJECT WORKBOOK

Tuesday, February 13, 2023

The Westlake Science & Engineering Fair gives Westlake students an opportunity to learn more about a topic they are interested in, gain valuable skills on the scientific process, develop creativity, organizational, critical thinking skills, and so much more! This packet will help guide you & your child through an **ENGINEERING PROJECT**. Not an experiment based project!

WHO CAN PARTICIPATE? ALL Westlake students!

WHO SUPERVISES? This is an at-home project supervised by a mentor. Each student needs a mentor to help them through the organizational components of the project. Mentors are an essential part of the science fair project and work as a **guide** from start to end.

* Note to mentors: Your role is to help students translate their interests into a scientific experience. You will help students navigate the steps of this process. Resources and examples to help you through this process can be found online at: http://www.supportwestlake.org/science-fair.html

MARK YOUR CALENDAR

Before you get started, get organized, look at your calendar and create a timeline that works for you. Fill in the "Goal Date" column below then add them to each section of the packet.

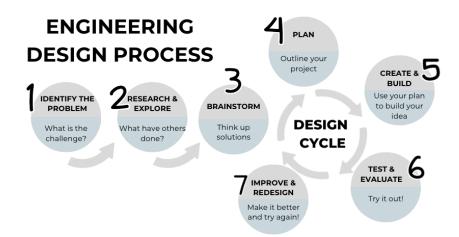
Goal Date	Suggested Duration	STEPS TO COMPLETION
	1 week or less	Find a mentor
	1 week	Step 1: Identify a problem you want to solve
	1 week	Step 2: Build understanding (RESEARCH and EXPLORE)
Friday, Dec. 15th	1 day	Pick up your poster in the MUR after school
	1 weeks	Step 3 & 4: Brainstorm and Plan (1st ½ of Design Cycle 1)
	2 week	Steps 5 & 6: Build and Evaluate (2nd ½ of Design Cycle 1)
Wed., Jan. 17th		REGISTRATION CLOSES (online preferred!) http://www.supportwestlake.org/science-fair.html
	1-2 weeks	Improve your design (Design Cycle 2)
	1 week	Finalize your project (Design Cycle 3)
	1-2 days	Organize your results and write your conclusions
	1 week	Design and create your poster board
	1 week	Practice your presentation
Monday, Feb. 12th		Set up your Project in the MUR <u>after school</u> (12:15-1:15)
Tuesday, Feb. 13th		WESTLAKE SCIENCE FAIR 8am-12pm judging, 6:30-8pm Open to Families
Sat, March 9th		County Science Fair

 $Questions? \ \ Contact: \underline{westlake.sciencefair@gmail.com}$

More resources at: http://www.supportwestlake.org/science-fair.html

ENGINEERING PROJECT WORKBOOK

Let's Get Started!



An **Engineering Project** involves finding a problem, designing a solution to that problem, then testing and revising your project to determine the most effective solution.

This guide will lead you through the steps to a successful project. Remember you need to write down all your ideas and progress in a **notebook** or use the worksheet at the end of the workbook and paste that in your notebook. The icon will remind you to make a new **notebook entry** with a <u>Title and Date</u>. Use the **c**checkboxes to mark your progress.

SECTION A: FORM YOUR IDEAS

Before you start Find a Mentor!	Goal Date:
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A mentor should be ...

- > Someone comfortable guiding your scientific thinking
- > Willing to talk with you multiple times over the course of the project
- Someone who will keep you on track, organized and help you access the online resources at http://www.supportwestlake.org/science-fair.html

My mentor is.	
IVIN THE HELL IS	

Judges might ask you:

- Who helped you with your project?
- In what parts of the project was their help most useful?

🤚 STOP! Make sure you have a Mentor before you continue. 🦫



Choose a problem you are interested in solving

Coal	Date:	
CiOOII	Date:	

IMPORTANT RULES: Special project approval is required BEFORE STARTING if you are studying people, vertebrates (animals with bones), handling human or animal tissues or fluids, microorganisms, rDNA, chemicals (cleaning agents, solvents, organic chemicals) hazardous equipment (UV light, rockets), or controlled substances (anything that the student cannot legally purchase). Projects with harmful fungi (mold) or bacteria must be performed in a lab setting.

MENTORS: Email <u>westlake.sciencefair@gmail.com</u> with the potentially unsafe category from the above list and provide a short explanation of how you, as the Mentor, will provide a safe experience for your student and/or others while conducting this experiment.

NOTE: Projects that include mold will not qualify for the county science fair

Your project idea should be ...

- Most importantly, something you find interesting.
- > A problem that requires an engineered solution.
- > Something based on components that can be measured clearly, such as time, weight, distance, height, volume, things you can count, etc.

Notebook entry: Topics of Interest
☐ Make a list of topics that you find interesting to you
o 3-5 topics I am interested in are
\square Talk to your mentor about possible ideas to pursue based on this list.
 The topic I am most interested in is because
Notebook entry: Engineering Problems to Solve
☐ Brainstorm problems you want to solve.
☐ Choose a problem that you can design a solution for
 Think: Can I measure it? Can I get the materials? Will it help people?
 Sketching out your ideas might help!
 How might (<u>idea I could engineer</u>) help solve (<u>problem or challenge</u>)?
The problem I am trying to solve is:

Judges might ask you:

- How did you come up with the idea for your project?
- What questions did you have about your topic that you needed to answer?

💡 Your initial question may change as you go through the research process! 💡

• Do you think your project will help people?

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More resources at: http://www.supportwestlake.org/science-fair.html



Build understanding by EXPLORING & doing RESEARCH

Goal	Date:

Before you begin your project, you will need to learn more about your topic. This could be done through playing with your ideas and materials, talking with people/experts or learning more through research.

蓋蓋	Notebook	entry:	Research	& Ex	plorations

- ☐ Write down what you already know about your topic. (Personal stories, things you've seen, watched or read). These are your *prior experiences*.
- ☐ With the support of your mentor, gather information about your topic.
 - o Play around with your ideas to learn more and see if there are surprises
 - o Have conversations with people or experts in your field
 - o Do research with books, videos, or websites
 - o Write down important questions you have about your topic
- ☐ Keep a list of the resources you used in your research.
 - ♀ As you learn more, revise your original problem if needed!♀

Judges might ask you:

- What prior experiences did you have with these ideas?
- What ideas did you learn while doing your research?
- What resources were most useful for you in your research?

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More resources at: http://www.supportwestlake.org/science-fair.html

SECTION B: DESIGN CYCLE

Design cycle is the process of testing then adjusting the solution to your problem. You will cycle through steps 3-7 several times as you test and improve your solutions. Use the form at the end of this packet to help you through this process. You can tape this sheet in your notebook. More resources can also be found online: http://www.supportwestlake.org/science-fair.html



BRAINSTORM	
Think up solutions	

Brainstorm ways to SOLVE your problem

Goal Date: _____

Notebook entry: Brainstorm

- ☐ Using what you know to brainstorm ways to solve your problem
- ☐ Draw your ideas or write down your thoughts as you imagine solutions
- ☐ Do some research if you get stuck.



Plan your project

Goal Date: _____

Now that you know more about your topic and have ideas on how to solve it, it's time to make a plan that describes how you will carry out your project.

Notebook entry: Project Outline

- ☐ Explain each part of your engineering design project.
 - o <u>Define the problem:</u> Explain the situation you're trying to solve.
 - o Name your solution: Write your idea for a solution to that problem.
 - Explain how you will know it works: Name a few things that you will use to measure the success of your solution.
 - What will you Measure to show proof of it working: Measurements you will take to evaluate your design solution.
 - o Make a prediction: What do you think will happen?

See examples at http://www.supportwestlake.org/science-fair.html

Judges might ask:

- How did you design a solution?
- What steps did you take to ensure someone else doing the same investigation could get the same data/results?
- What proof do you have that your project works?

5 CREATE & BUILD	
Use your plan to build your idea	

Create and build your idea

Goal Date: _____

	List the	materials	vou will	need fo	r vour	proie	ect.
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- ☐ Collect your materials. Talk with your mentor if you need to purchase anything.
- ☐ Take a picture of your project.



Run your test, collect and interpret your data

Goal Date: _____

Notebook entry: Data and Observations

- ☐ Write down your observations
 - o I notice .
- ☐ If you collected data, make a display of your data (graph, chart) to help you understand and communicate the results. Remember to include the unit of measurement!

Notebook entry: Results

- ☐ Explain what happened and **why**.
 - Was your hypothesis supported or not supported?
 - Was your solution successful? Why or why not?
 - o If you are unsure, discuss with your mentor or do more research.
 - Use words or drawings to describe your thinking. Refer to the science you learned through your research.



Improve your design

Return to step 3 and make improvements. We recommend 3 design cycles.

Judges might ask you:

- What challenges came up when you were doing your engineering cycles?
- How many design cycles did you do (tested, modified, re-designed)?
- Did you do any calculations during your project?
- How would you explain your results?
- Could your results be based on random chance? (hint: how much data did you collect? More data = less chance) Why or why not?
- What surprised you about the results of your work? Did the results match your predictions?
- Did the results change your way of thinking about the situation? How so?

SECTION C: FINAL STEPS

Step 8: Draw Conclusions and Reflect	Goal Date:
Notebook entry: Conclusions	
Construct an explanation of your results based on your science.	our research and understanding
$\hfill\square$ How have your ideas changed based on what	happened?
Notebook entry: Reflections and Next Steps	
 □ What went well with your tests? □ What challenges did you have? Were there mi □ List new questions about your topic based on a second of the second of the	your results.
Judges might ask you: • What new questions did you have after you collected.	
- Mandaithan valuable to collect macro data 2 Mby	ar 14 /b1 / p a+2

- Would it be valuable to collect more data? Why or why not?
- How could your project help people?

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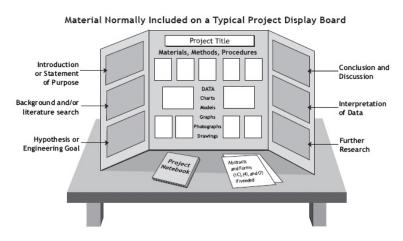
SECTION D: SHARE YOUR PROJECT

STEP 9: Design a Poster Board Presentation Goal Date: _____

Design a poster board to tell the story of your project. Use your creativity and have fun making your board! Projects may be typed or handwritten, all writing must be NEAT and LEGIBLE. There is no one way to make a poster board, but be sure to include the sections listed below.

- ☐ Pick up a poster board from the MUR on **Friday Dec 15th**
- ☐ Neatly write or type your:
 - Problem and Purpose
 - o Research. List a few things you learned and your sources (from step 2)
 - Materials (from all design cycles)
 - Design Cycle One: Procedure (Plan from step 4), Hypothesis, Results (Data Tables, Charts, Graphs that include captions)
 - Additional Design Cycles (How did you redesign? What were your results? Did it improve your project?)
 - Conclusions & Next Steps
 - Acknowledgements
- ☐ Think of a title for your project
- $\hfill \square$ Make sure titles, subtitles and text are large enough to read
- ☐ Arrange all parts on your poster board make sure they fit before gluing down!
- ☐ Remember to bring your notebook!
- ☐ Include props or samples (if possible) so people can interact with your project. Electricity will not be provided. You will only have 1x2 feet of table space in front of your display.

EXAMPLE BOARD:



Judges might ask you:

- What was one of the highlights of your project?
- What was a challenge you faced?
- If you did this project again, is there anything you would do differently?
- If you decided to work more on this idea, what would you do next?

STEP 10: Practice your Presentation Due date:

Have your mentor and other adults ask you questions about your project. Go back through this packet and check out some of the questions judges might ask you to help you prepare.

STEP 11: Acknowledge your helpers

Notebook entry: Acknowledgments

Congratulations, this is the last entry in your notebook! Write a few sentences about who helped you and how they helped you.

Judges might ask you:

- Who helped you on your project?
- Which parts of your project did you receive help with?

Looking forward:

Save the Date! March 9th is the Santa Cruz County Science Fair. The top projects will be recommended but all students who want to compete may attend. Last year Westlake students took home the most prizes as anyone in the county.

You will need to register online after the Westlake Fair. More information can be found online at:

https://sites.google.com/santacruzcoe.org/santacruzsteamexpo/home

Questions? Contact: westlake.sciencefair@gmail.com

More resources at: http://www.supportwestlake.org/science-fair.html

DESIGN CYCLE NOTES

Use this worksheet if it is helpful! Feel free to cut this out and put it in your notebook.

Design Cycle Worksheet (steps 3-7)		
Step 3	Brainstorm: Draw	
	your ideas and	
	make some notes	
Step 4	State the problem	
	Nama + ba dasirad	
	Name the desired solution	
	Solution	
	Explain how you	
	will know it works	
	What will you	
	measure	
	Predict what will	
	happen (Make a	
	hypothesis)	
Step 5	Create and Build	
	your idea. List the	
	materials you	
	need.	
Step 6	Run a test of your	
-	model and write	
	down	
	observations	
	Record your data	
	Record your data	
Step 7	Improve your Design	
	Go back to Step 3 and perform another Design Cycle	
	We recommend you perform 3 Design Cycles.	

