LATHROP ENGINEERING

Name:

UNIT 3: MATERIALS & MACHINES

Engineering, Design & Development (Senior Design) Unit Due Date: **October 18, 2019**

Our third unit looks at the cool things that different materials and machines can accomplish. We'll start with a look at different materials before we design our own materials research. Then we'll look at different kinds of machines, how they work, and what they can do. Together you'll want to be thinking about how different materials and their properties work with machines to make things happen! You'll get to

- Learn about different materials and brainstorm uses for them
- Research a material of your own choosing and do some statistics!
- Learn about different machines and brainstorm similar applications
- Sketch & Identify machines of different types

As we move through this unit, you are responsible for making adequate progress through the assignments, and for being done by the Unit Due Date (**October 18, 2019**). You are also responsible for completing each part before moving on to the next. Our unit is broken up into three main parts:

Part 1: **Materials** *(40 pts) Approx. 4 days*		
The first part of this unit is all about materials and material properties. You'll start by watching some fun videos about cool materials that already exist. For each of them you'll brainstorm 10 possible uses for that material. Then, you'll identify some material available in our lab and design your own materials research! You'll then plan out a study about that material, have a plan approved, and collect some real data. In the end, your notes and data should be summarized in a full page report in your engineering notebook.		Materials Notes & Brainstorm
		Plan Materials Research
		Have Benshoof Approve Research
		Conduct Materials Research
		Research Notes & Summary
		Check-off from Mr. Benshoof
Achievement: Include a statistical analysis of your materials data in your final summary		

Part 2: **Machines** *(40 pts) Approx. 3 days*		
The second part of our unit is about machines. You'll start with an overview of the 6 simple machines and what they do in the real world. Then, you'll look at some cool complex machines that really exist and think about how similar machines could be used to do awesome new things. Finally, you'll pick one of complex machines in the Makerspace, and draw a careful diagram. You'll then identify and label as many simple machines inside the complex machine as you can.		Notes On Simple Machines
		Notes On Complex Machines
		Choose Complex Machine
		Draw Complex Machine
		Identify & Label Simple Machines
		Check-off from Mr. Benshoof

Part 3: **College Tasks** *(20 pts) Approx. 3 days**		
The final part of our unit is all about putting together an application for the Presidential Scholars Award for CTE & Engineering. Two (2) of our Lathrop seniors will be nominated for this state and national recognition, and you will spend some time putting together complete applications. Put together a good application, and have Benshoof edit your personal essays!		Compile Application Documents
		2-Page Personal Essay
		Mr. Benshoof's Edits!

(40 pts) Approx. 4 days

The first part of this unit is all about materials and material properties. We'll spend a little bit of time looking at some materials that already exist, and brainstorming new uses for them. Then you'll get to design your very own materials research, plan an experiment, and collect some data! We'll wrap things up with a short report and even some statistics.

1. Start things out by watching the overview video on our website *Materials Research*.
2. Then watch each of the four videos on unique materials. For each of them, take some notes about what the material can and can't do.
3. Then, for each of the four materials, brainstorm at least 10 new applications for those materials. How else could they be used (beyond what is suggested in the video) to make something new? Altogether, you should have at least 1 full page of notes and brainstorms on the various materials.
4. Now, think about the materials in the lab and pick one that you think would be fun to work with. Here are some ideas:
   Acrylic Lexan *3D Printer Filament* Carbon Fiber *Vinyl* Glues
   Sheet Metal Woods (various kinds) *Rubber* Foam (various kinds)
5. Once you've chosen your material, design some research that can be done on it to understand it better. Maybe you want to know how well it cuts in the laser. Maybe you need to know how strong it is, or how best to apply it in different circumstances. (Have Mr. Benshoof approve your research design)
6. Conduct your research. Be sure to record your process and results in your engineering notebook. Also be sure to include at least one drawing of your data collection apparatus.
7. Write a full-page summary of your findings in your engineering notebook. Include a statistical analysis for a bonus achievement!

Part 1: Materials Tasks	*10-7 points*	*6-3 points*	*2-1-0 points*
Materials Notes & Brainstorm	+ You took a page of notes on the 4 different materials videos. + You brainstormed at least 10 ideas for material applications	- You took less than a page of notes - You brainstormed less than 10 ideas for each	- No notes - Little or no brainstorming
	5 points	*4-3 points*	*2-1-0 points*
Plan Materials Research	+ You selected an appropriate material that we have available + You designed a study to test a property of that material	- You picked a basic material - Your design is not well thought out	- Your plan is missing
	15 points	*14-10 points*	*9-0 points*
Conduct Materials Research	+ You conducted your experiment multiple times + You followed your procedure + You collected at much data as you could in a reasonable time	- You did not repeat your experiments many times - Your research is lacking - Your procedure is not consistent	- You did not collect any data - Your results are noticeably wrong
	10 points	*9-5 points*	*4-0 points*
Research Notes & Summary	+ You took detailed notes on your research + Your notes include a picture of the data collection apparatus + You wrote a full page summary of your work and your results	- Your notes are missing important parts - Your notes do not include any pictures - Your summary is less than a page	- Your notes are significantly lacking - Your summary is missing
Achievement	+ Include a statistical analysis (graphs, descriptions of distributions, tests, or intervals) that is appropriate for your understanding of AP Statistics.		

(40 pts) Approx. 3 days

The second part of our unit focuses on machines of various kinds. Here you'll be asked to do some research of your own into the 6 simple machines. After that, you'll watch some videos on some pretty cool complex machines and take some notes. Finally, you'll investigate one of our lab's complex machines and draw and label a picture to illustrate how it works.

1. Start things off by watching the overview *Machine Research* video.
2. Then, do some research online into the 6 simple machines listed below. Take some notes on each (a total of 1 page), that include a picture of what they are and how they create mechanical advantage:

Inclined Plane	Screw	Pulley
Wheel & Axel	Wedge	Lever

3. Then watch each of the four videos on complex machines. For each, take some notes on how they work and which simple machines are at the core of their function. Brainstorm at least 5 other applications for those machines or for similar machines.
4. Next, pick one of the machines we have in the Makerspace & Lab. You can pick any of them, but some ideas are listed below:

CNC Router	3D Printer	*Tormach Mill*	Laser	*CNC Plasma*
T-Shirt Press	*Vinyl Cutter*	Large Poster Printer	*SSA1000 Press*	Saws or Drills

5. Find the machine you've chosen and draw a very detailed, full-page diagram of the main part of your chosen machine. It should be an impressive drawing… the kind you want to put up on the fridge at home.
6. Identify as many of the simple machines as you can within your chosen complex machine. Label them (all) on your diagram.

Part 2: Machines Tasks	*10-9 points*	*8-4 points*	*3-0 points*
Notes on Simple Machines	+ You did your own online research about all 6 simple machines + You took a full page of notes	- Your notes are less than a page - Your notes exclude a simple machine	- Your notes are lacking - You exclude more than one machine
Notes on Complex Machines	+ Your notes cover characteristics of all 4 complex machines + Your notes include brainstorming ideas for new applications	- Your notes are not a full page - Your brainstorming lists are not at least 5 ideas long	- Your notes are lacking - Your brainstorming is missing
Complex Machine Diagram	+ You chose a complex machine in the lab + Your diagram is very carefully drawn and includes all the parts/pieces	- Your drawing is missing key elements	- Your drawing is poorly done - You left out important parts of the machine
Simple Machine Labels	+ You identified and labeled at least one of every type of simple machine + You labeled as many simple machines as you could find	- You labeled fewer than 6 simple machines	- Your labeling is skimpy and lacking

(20 pts) Approx. 2 days

Congratulations! As a successful senior in Lathrop's Engineering Program, our school ***wants*** to nominate you for state and national recognition. Each year the Presidential Scholars Award for CTE & Engineering is given across the country. Our state gets to recognize and nominate 5 students statewide for the national recognition. That national recognition could come along with a free trip to Washington D.C., or even scholarship money… it changes yearly. What we get to do at Lathrop is identify 2 of our top CTE students for nomination to the state. Your work here will be putting together an application that can be used by our administrators to identify the 2 best candidates to nominate at the state level.

If you have detailed questions about the award or the application process be sure and talk to Mr. Benshoof!

1. ***COMPILE DOCUMENTS:*** The first and easiest part is to set aside 1 copy of your transcript, 1 letter of recommendation from a teacher, and the completed application page. These elements all need to be done for the final application, and so they are part of our school-level application.

2. ***2-PAGE PERSONAL ESSAY:*** Here you need to take some time to write a 2-page personal essay. The criteria and constraints are as follows:
    - ***a.*** Essay must be TITLED
    - ***b.*** Essay must be TYPED, DOUBLE SPACED, and exactly 2 PAGES
    - ***c.*** Essay must highlight your:
        - ***i.*** Technical competence in engineering
        - ***ii.*** Academic proficiency across content areas
        - ***iii.*** Leadership & employability skills
        - ***iv.*** Ingenuity & creativity in solving real world problems of import to their community within the scope of engineering

Part 2: College Tasks	*10-9 points*	*8-4 points*	*3-0 points*
Compile Application Documents	+ You compiled your transcript, 1 teacher recommendation, and filled in the application information page	N/A	0 points only if - You missed any one of those three things
Personal Essay	+ Your personal essay is 2-pages long + You discuss all the necessary parts + Benshoof edited your essay	- Your essay is less than 2-pages long - Your essay misses an element from the prompt	- Your essay is less than 1-page long - Your essay misses multiple elements from the prompt