

Build something hydraulic or pneumatic

Worth up to 10 additional points for your current quarter grade, and an increase in your license to learn level.

****Important Notes:**

- You are allowed to work with one additional student on this project. Each student will receive an identical grade for the final product.
- Your end of quarter grade cannot exceed 100%. Any remaining points from this and other extension projects will be moved to the following quarter.
- You will be provided with two to three small syringes and a length of pvc tubing that fits tightly on the ends of the syringes. These materials are only handed out when your design and research have been completed and you have met with me.

Goal of Extension Project: Students will design and build a pneumatic (air powered) or hydraulic (water powered) machine.

Step #1 - Do your research:

Before you are given any supplies you need to do a bit of research to determine what exactly is pneumatic and hydraulic power. You will also need to come up with a plan of what you actually plan on building. **You MUST complete all of the following questions and provide credible resources (like I taught you in class) for the information you provide. You must set up a meeting time with Mr. Stark (before or after school) to review all of the information for step #1. This will get you your materials and the "go ahead" to begin building.**

I am going to give you a head start with some of the research by providing you with a few different links for hydraulics and pneumatics along with some links that compare the two. Click on the links within the table to view the sites and use the information you have found to answer the questions below.

Hydraulics	Both	Pneumatics
http://www.explainthatstuff.com/hydraulics.html	https://www.youtube.com/watch?v=YImRa-9zDF8	http://www.explainthatstuff.com/jackhammer.html
http://science.howstuffworks.com/transport/engines-equipment/hydraulic1.htm	http://www.engineerstudent.co.uk/pneumatics_vs_hydraulics.html	http://examples.yourdictionary.com/examples-of-pneumatics.html
http://www.nfpa.com/fluidpower/whatis hydraulics.aspx	http://www.differencebetween.net/science/difference-between-hydraulics-and-pneumatics/	http://www.nfpa.com/fluidpower/whatis pneumatics.aspx

1. Explain how gases, liquids and solids respond to being compressed.

2. What is hydraulics?
3. How does a hydraulic system, such as a water gun work? **Both explain and draw a picture** of how the system works.
4. What is pressure? What does pressure have to do with Pascal's principle?
5. What does hydraulics have to do with how an excavator (digger) works? Explain how a hydraulic system is responsible for the work an excavator can do and how this works.
6. Discuss the main components of a hydraulic system.
7. What is pneumatics?
8. What is air made up of?
9. How does a pneumatic system, such as a jackhammer, work? **Both explain and draw a picture** of how the system works.
10. Give ten examples where we can find pneumatic power being used.
11. How does a hydraulic system compare to a pneumatic system?

12. How does a hydraulic system contrast to a pneumatic system?

13. What are the strengths and weaknesses of both hydraulic and pneumatic systems?

14. Let's now connect what you have learned about hydraulic and pneumatic power to building a machine! The first step will be to look at what other folks have already built. Check out the following links that I have found (you are welcome to research more) about building hydraulic and pneumatic machines using syringes.

Hydraulic / Pneumatic Lifting Machines and other machines

- https://www.youtube.com/watch?v=pRHTpag7_K0
- <https://www.youtube.com/watch?v=Wh344OKyAUM>
- <https://www.youtube.com/watch?v=vsF95qA1x7I>
- <https://www.youtube.com/watch?v=VFje0G69ku8>
- <https://www.youtube.com/watch?v=Eh0kyhEa8g8>
- <http://www.instructables.com/id/Simple-Pneumatic-Machine/>
- <http://www.instructables.com/id/Pneumatic-Arm-DIY/>
- <http://www.instructables.com/id/Pneumatic-Lift-Kit/>
- <http://www.instructables.com/id/JCB-from-syringes/>
- <http://www.instructables.com/id/EXCAVATOR-WITH-SYRINGE-HYDRAULICS/>
- <http://www.instructables.com/id/Easy-Hydraulic-Machines/>
- <https://grabcad.com/library/toy-hydraulic-arm-1>
- https://www.google.com/search?q=hydraulic+syringe+projects&safe=strict&rlz=1C1CHBF_enUS727US727&biw=1280&bih=894&source=inms&tbm=isch&sa=X&ved=0ahUKEwjw4KfqgOPRAhWK7SYKHYEKCYkQ_AUIBigB#imgsrc=ChBAxsjt2eda3M%3A (With this I just searched "Google Images" with "hydraulic syringe project" and a world of ideas come up... in other words don't limit yourself to the ideas presented in the information above!!!)

Step #2 - Design:

Now that you have some solid information under your belt, it is time to design your machine! You will need to provide a list of materials, the tools you will need to build the machine, and a clearly detailed 1:1 (one-to-one) drawing of your machine using graph paper. Please get graph paper from Mr. Stark if you do not have any of your own. Label all components on your graph paper clearly and make sure it is easy for another person to make sense of what your plans are.

- I. **First of all you need your machine to do some sort of work / job. What do you want your machine to do? By the way, THIS IS VERY IMPORTANT TO INCLUDE!**

II. Supplies Needed (include the quantity/amount of each material inside the parentheses):

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- ()
- ()
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- ()
- ()
- ()

II. Tools you will need to use:

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III. Complete a 1:1 scaled drawing (actual size) of your machine on the graph paper provided to you. Make sure to include the following with your drawing:

- A. Label all components
- B. Include all measurements
- C. Details on any specific procedures you will need to follow to build your machine

IV. Explain exactly how your machine will work in as much detail as possible.

V. Signature to Proceed to Building Process X_____

****Don't forget to include your sketch with this packet when you meet with Mr. Stark****

Step #3 - Build and record:

Once you have the “go ahead” to proceed, figure out your plan of action, gather up your materials and begin the building process. Please do the following while you build:

- Record the materials and methods used to build the project.
- Take **photographs and / or video record** the entire building process so that we can see how you actually accomplished this task (you should have a minimum of **twenty** pictures or 3 minutes of video footage to use for the final communication)
- Test what you have built and record how it performs, then adjust it to make it perform better, record this data. You should take photos / videos of it doing its job.
 - Be creative, use parts of old and/or broken toys, appliances, or anything else that is probably destined for a landfill
 - Be ingenuitive, take the time to find that perfect “something” that does the job. Think gears, metal rods, paperclips, springs, or anything else that completes the job.
 - Don’t settle, once you think the machine is good, test it, test it again, and then once more, make modifications to make it the best you possibly can. Take your time with this, but don’t stress, have fun... **and do your research!!!**

Step #4 - Communicate the project:

You **WILL NOT** use google slideshow to communicate your information. Those days are done. Let’s use something that will reach more people and will insure that the quality of the work you are creating is above and beyond the norm. You have three options to communicate your project.

- One option is using **Youtube** to create a “build it” video with the purpose of instructing another person on how to build your machine and use it.
- Option two is to complete an **instructable** by signing up (via your WRSD account) for instructables at <https://www.instructables.com/account/register/> and linking your google account. You should familiarize yourself with the process of creating an instructable by exploring other people’s instructables and seeing what makes a good one and what makes a bad one.
- The third option is to create a clear poster presentation to be hung up outside the classroom. Basically you are creating a paper version of an instructable.

No matter which option you choose, your form of communication must include the following:

1. An introduction to your project and who you are. **Clearly state the goal of this project right at the start of your communication.**
2. Details about what both hydraulic and pneumatic power are and what the differences are between the two types of power. Show where both hydraulic and pneumatic power are used with other machines.
3. Introduce your machine and talk about what type of power is being used to make the machine do work. Describe where you got your information from to design and build the machine you decided to build.
4. The design process for the machine and where you acquired your ideas from
5. The necessary tools, materials, and skills needed for the project
6. Video footage and / or pictures of the building process
7. Video footage and / or pictures of the testing process
8. Additional information about the modification of your machine to make it perform better
9. Conclusion and details on the results of testing the machine

Important Notes**

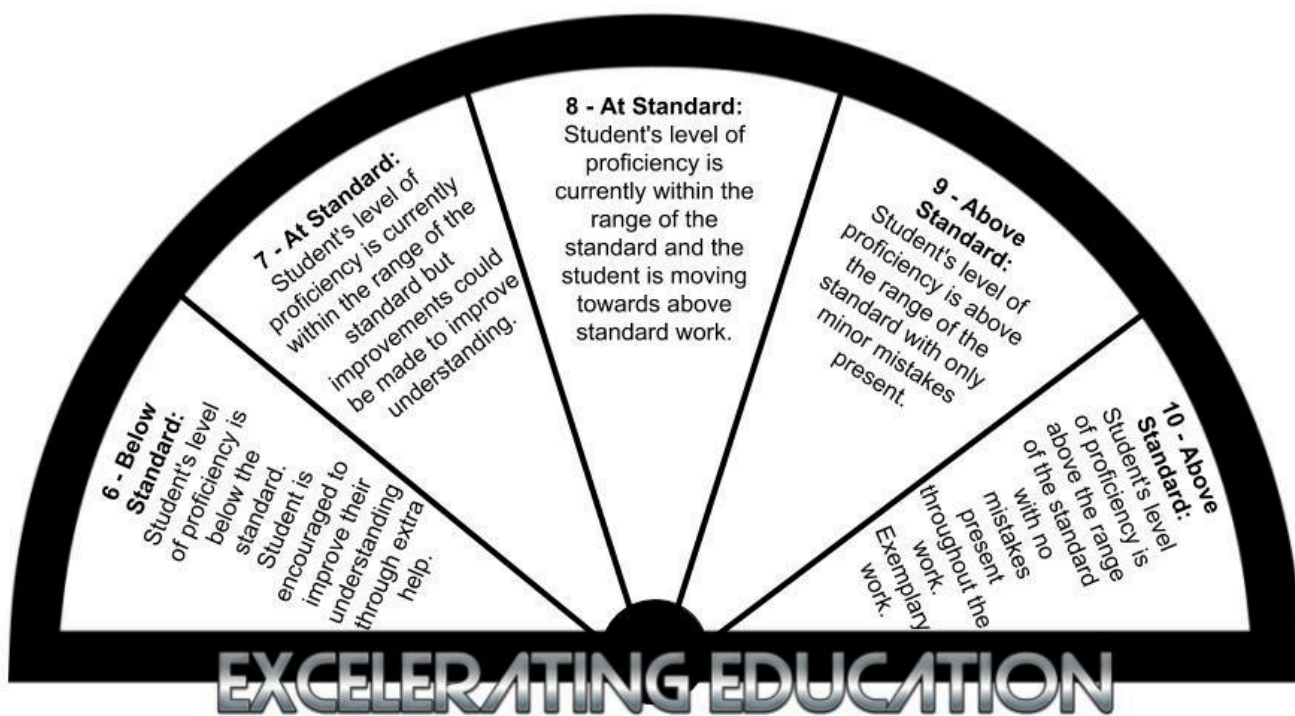
- People all around the world might see your work, make sure it is the highest quality possible and the best you possibly can do
- Check your spelling and grammar - errors are just embarrassing
- Come in for extra help with the youtube videos, instructables, or anything else, but DO NOT wait until the last moment
- Plan ahead... this is going to be a tough project overall, but a really fun one.
- Finally, please DO bring your hydraulic / pneumatic machine into school on the due date so that we can all see it live and in person. You will bring it home on the same day.

Rubrics for different forms of communication:

Youtube Video Rubric

Did the communication include...

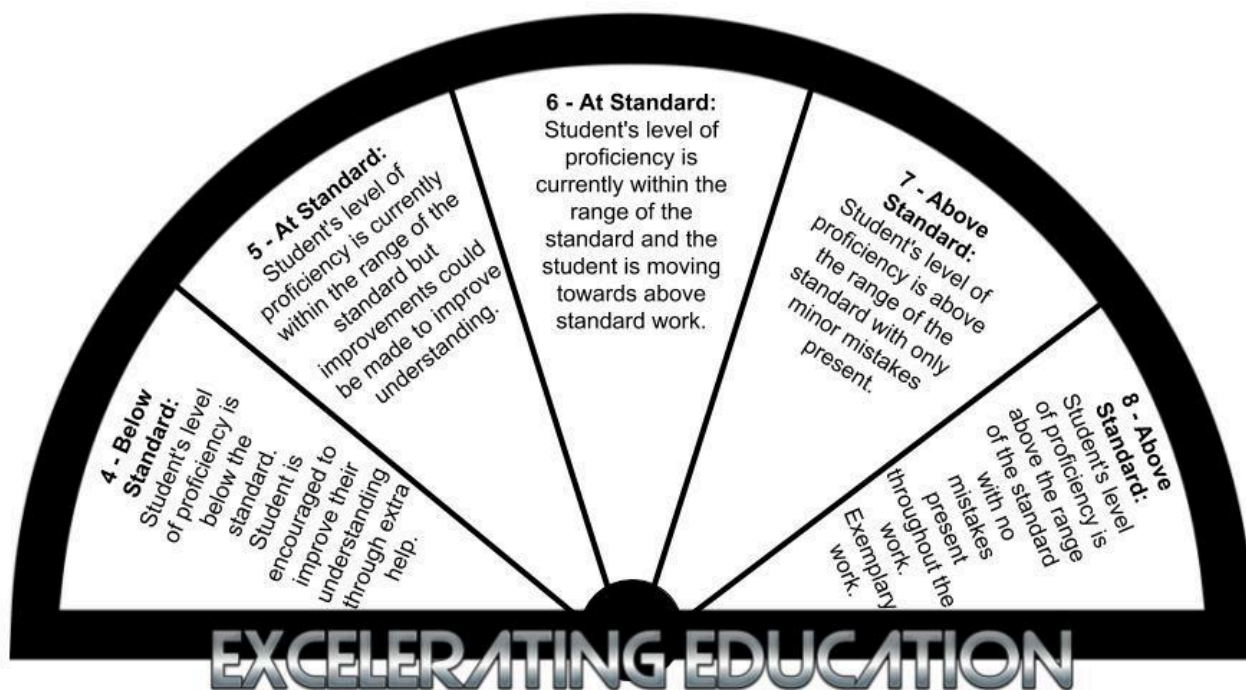
- ☐ An introduction to your project and who you are. **Clearly state the goal of this project right at the start of your communication.**
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Instructable Rubric

Did the communication include...

- ☐ An introduction to your project and who you are. **Clearly state the goal of this project right at the start of your communication.**
- ☐ Details about what both hydraulic and pneumatic power are and what the differences are between the two types of power. Show where both hydraulic and pneumatic power are used with other machines.
- ☐ Introduce your machine and talk about what type of power is being used to make the machine do work. Describe where you got your information from to design and build the machine you decided to build.
- ☐ The design process for the machine and where you acquired your ideas from
- ☐ The necessary tools, materials, and skills needed for the project
- ☐ Video footage and / or pictures of the building process
- ☐ Video footage and / or pictures of the testing process
- ☐ Additional information about the modification of your machine to make it perform better
- ☐ Conclusion and details on the results of testing the machine



Poster Rubric

Did the communication include...

- ☐ An introduction to your project and who you are. **Clearly state the goal of this project right at the start of your communication.**
- ☐ Details about what both hydraulic and pneumatic power are and what the differences are between the two types of power. Show where both hydraulic and pneumatic power are used with other machines.
- ☐ Introduce your machine and talk about what type of power is being used to make the machine do work. Describe where you got your information from to design and build the machine you decided to build.
- ☐ The design process for the machine and where you acquired your ideas from
- ☐ The necessary tools, materials, and skills needed for the project
- ☐ Video footage and / or pictures of the building process
- ☐ Video footage and / or pictures of the testing process
- ☐ Additional information about the modification of your machine to make it perform better
- ☐ Conclusion and details on the results of testing the machine

