

Name \_\_\_\_\_

Day and hour \_\_\_\_\_

# **Basic Engineering Workbook**

Valley Middle School of STEM

2016-2017



Original Artwork by ME!

## Engineering

1. What is Engineering?

2. What are the 7 steps of the “*Collaborative Design Process*” (problem solving process)?

A.                      B.                      C.                      D.  
E.                      F.                      G.

3. Looking through the “*Engineering Is...*” packet,

A. Which engineering job was most surprising to you? Why?

B. Which of those engineering jobs would you be most likely to choose (if you HAD to be an engineer? Why?

C. What is the average starting salary for an engineer with a bachelor’s degree? \$

How about a petroleum engineer? \$

## 3D Printing

4. List 4 types of material that can be used for 3D printing:

A.                      B.                      C.                      D.

5. Why is 3D printing a prosthetic hand so much better than buying one?

6. What is 3D printing also known as?

## **Apollo 13 Video Clip**

7. What was the significance of the box of “junk” they dumped on the table (why did they use that stuff)?

8. What is ONE of the differences between the engineering done by NASA, and the engineering that will be done by you in class:

## **PBS Design Squad Video: “Cardboard Furniture”**

9. What is the challenge or problem each team needs to solve?

10. List 2 major problems the teams ran into during the challenge:

A.

B.

11. Which team do YOU think will win and why?

Which team actually won?

## Vinyl Cutting

1. What is the name of the program we use for designing/ preparing graphics for the vinyl cutter?

2. What file type does the graphic need to be to work with that program (when copying and pasting)?

3. When choosing a graphic, less detailed, black and white graphics work the best. Why?

### 4. What are the steps once you find your graphic?

A. In Google, right-click \_\_\_\_\_.

B. Then go to C\_\_ S\_\_\_\_\_ and right-click \_\_\_\_\_.

C. Then right-click on the graphic and choose \_\_\_\_\_.

D. Then click the button \_\_\_\_\_.

E. Move outlined graphic out of the way, click on original graphic and \_\_\_\_\_.

F. Change your grid to 1" x 1" (file: preferences: grid: horizontal & vertical = 1)

G. Resize your image by holding \_\_\_\_\_ while dragging from the corner of the graphic with your mouse... this will keep the graphic in proportion.

### 5. What are the 6 steps when using the BIG vinyl cutters?

A.

B.

C.

D.

E.

F.

### 6. What are the 4 steps when using the SMALL vinyl cutter?

A.

B.

C.

D.

# RUBE GOLDBERGS

1. Who is Rube Goldberg?
2. What is a Rube Goldberg?
3. What is an energy transfer?

## **Simple Machines**

4. List the 6 simple machines:

- A.
- B.
- C.
- D.
- E.
- F.

5. Honda Commercial- Write down an example of how each simple machine was used in the commercial:

Simple Machines	How it was used
Example: Wheel	Rolling cog
1	
2	
3	
4	
5	
6	

## **Rube Goldberg Challenge:**

Using the VMSS Collaborative Design Process in a group of no more than 3 people, design, create, and test a machine that will complete a simple task (a Rube Goldberg). Every group's machine will complete the same task. It has to ring a bell.

### 1st step:

Plan your machine. Research Rube Goldbergs online by watching videos and looking at diagrams of other Rubes.

Your drawings must include the following:

- 1. All of the six simple machines.*
- 2. 11 or more energy transfers*
- 3. ALL parts, simple machines, and energy transfers should be labeled.*
- 4. Design/plan/drawing needs to be graded before starting to build.*

### 2nd step:

Build your machine, test it, make changes, re-test, etc...

- 1. Get a cardboard base from the teacher. Build your machine on this base. Use up to 3 pieces of cardboard for base and walls.*
- 2. Include all six simple machines*
- 3. Machine needs to have 11 or more energy transfers*
- 4. Everyone in the group should be participating*
- 5. Aesthetics will be graded (how it looks). The more time you spend making parts carefully, the better the machine will operate (if it looks janky, it probably won't work as well!)*
- 6. Does it ring the bell???*

### 3rd step:

Test your machine.

1. *Each time your machine stops that counts as 1. Add those up and subtract from the total amount of energy transfers. Then divide that number by the total amount of energy transfers. This will give you the percentage of successful energy transfers (example: stopped 2 times. Total energy transfers 11.  $11-2=9$ .  $9/11=81\%$ .*
2. See rubric... **81% would be 12/16 points** for the energy category.
3. BEFORE final testing of your Rube Goldberg machine, make sure it works over and over and over.

### How to problem solve:

1. Identify problem (example: marble keeps getting stuck)
2. Brainstorm solutions (example: smaller marble, bigger slant, etc)
3. Try solutions
4. Evaluate (did any solutions work???)
5. If yes, great! If no, brainstorm some more!