



Student Worksheets

Rube Goldberg Machine

Wonderville.ca Science Challenges
Grade 8: Mechanical Systems

Team Worksheet 1 - The Challenge

Hello Junior Engineers! We here on Wonderville hear that you've been studying Simple Machines. We are looking for a team that can use simple machines and show us how they can work together to accomplish a task. We're looking for you to build us a machine that uses as many simple machines as possible to extract a marble from a tube.

The machine you are inventing is part of a group of machines called Rube Goldberg devices. These machines use a series of simple machines to accomplish a task. We want to learn as much about simple machines as possible – so remember use as many different types as you can.

We are looking for the team who can best show us how simple machines work. Here are some rules to let you know what we're looking for:

- Work in teams of no more than 4 people.
- Design a Rube Goldberg device to extract a marble from a tube. Make sure your machine fulfills the following requirements:
- Uses at least three simple machines: Lever, Inclined Plane, Wedge, Screw, Pulley, Wheel and Axle, Gears and Hydraulics
- Input (start the motion) can be one movement (push, drop, crank, pull etc)
- Last no longer than two minutes from initiating the first movement

After you've built and tested your Rube Goldberg device we need you to present it to our panel of judges. Film a presentation to show our panel of judges your fantastic machine and post it to the science challenges website. They are also going to need a drawing of your machine along with a picture and description.

For your presentation you need to be able to discuss the following points:
Introduce the team and discuss what type of simple machines the team used to lead up to the extraction of the marble?
Indicate where the Lever, Inclined Plane, Wedge, Screw, Pulley, Wheel and Axle and Gears, and Hydraulics are within the Rube Goldberg device.
Indicate why the team chose those machines and if you could start again, what would you change or do differently.

Team Worksheet 4 – Materials

Materials to bring from home and to get from school

Ask each member of the team to bring in various materials.

List who will bring what material on this sheet and each team member should put the items in their agenda. Decide what day the materials are to be brought to the class.

Name	Materials to be brought to class

Team Worksheet 5 – Building the Device

Your team gets to build a Rube Goldberg device using as many simple machines as you can to extract a marble from a tube. Below is your team's checklist to make sure all team members remember the criteria. This could take 2 or 3 days. Your teacher will let the class know how many class days you will have to build the device.

The challenge is to extract a marble from a tube using a Rube Goldberg device that will fulfill the following requirements:

- Use at least three machines of Lever, Inclined Plane, Wedge, Screw, Pulley, Wheel and Axle, Gears and Hydraulics. Remember – the more machines the better!
- Input (start the motion) can be one movement (push, drop, crank, pull etc)
- Last no longer than two minutes from the starting movement

Steps to take before and during building

- Make sure you have a preliminary drawing of the machine
- Look over your materials – Do you have all materials to get started?
- Let each team member choose a section of the project to build
- Reevaluate as the team goes
- Does it make sense?
- Do we have at least three different simple machines?
- Have we measured the distance when one section works?
- What else can we do or change to make it better?
- Do test runs.
- Troubleshoot and make the necessary modifications
- Start over if the project does not meet the requirements.
- Once the team is satisfied with the project, make final touches to make sure that the time from starting movement to extraction of the marble is no longer than 2 minutes.

Team Worksheet 5a – Scientific Drawing

As a team of Junior Engineers you must communicate to the panel of judges about your machine. Remember – the judges are looking for a diagram that identifies:

- all the simple machines (if you don't label them, they won't count!)
- all the materials you used
- time it takes to extract the marble

Be sure that your scientific drawing is clear, neat, and accurate.

What to Do

Use unlined paper, a sharp pencil, a good quality eraser and ruler.

Draw a side profile of your device.

Give yourself plenty of space. Your diagram should be at least 1/2 page in size. You need the space to add labels and captions to your drawing.

Neatly label the machines in your drawing. Make sure you label all the machines you use (Lever, Inclined Plane, Wedge, Screw, Pulley, Wheel and Axle, Gears and Hydraulics). Using a ruler, draw lines from the detail you are naming to the margins of the paper. Make sure the line clearly touches the part of the drawing you are labeling.

Neatly label all the materials you used. Using a ruler, draw lines from the detail you are naming to the margins of the paper. Make sure the line clearly touches the part of the drawing you are labeling.

Labels identify the parts of the object you are drawing. Place labels on the right side of your drawing unless putting them all on the one side would make your drawing cluttered. Use your ruler to draw lines to the different machines. Make sure none of your label lines cross.

Draw only what you see and keep your drawing simple.

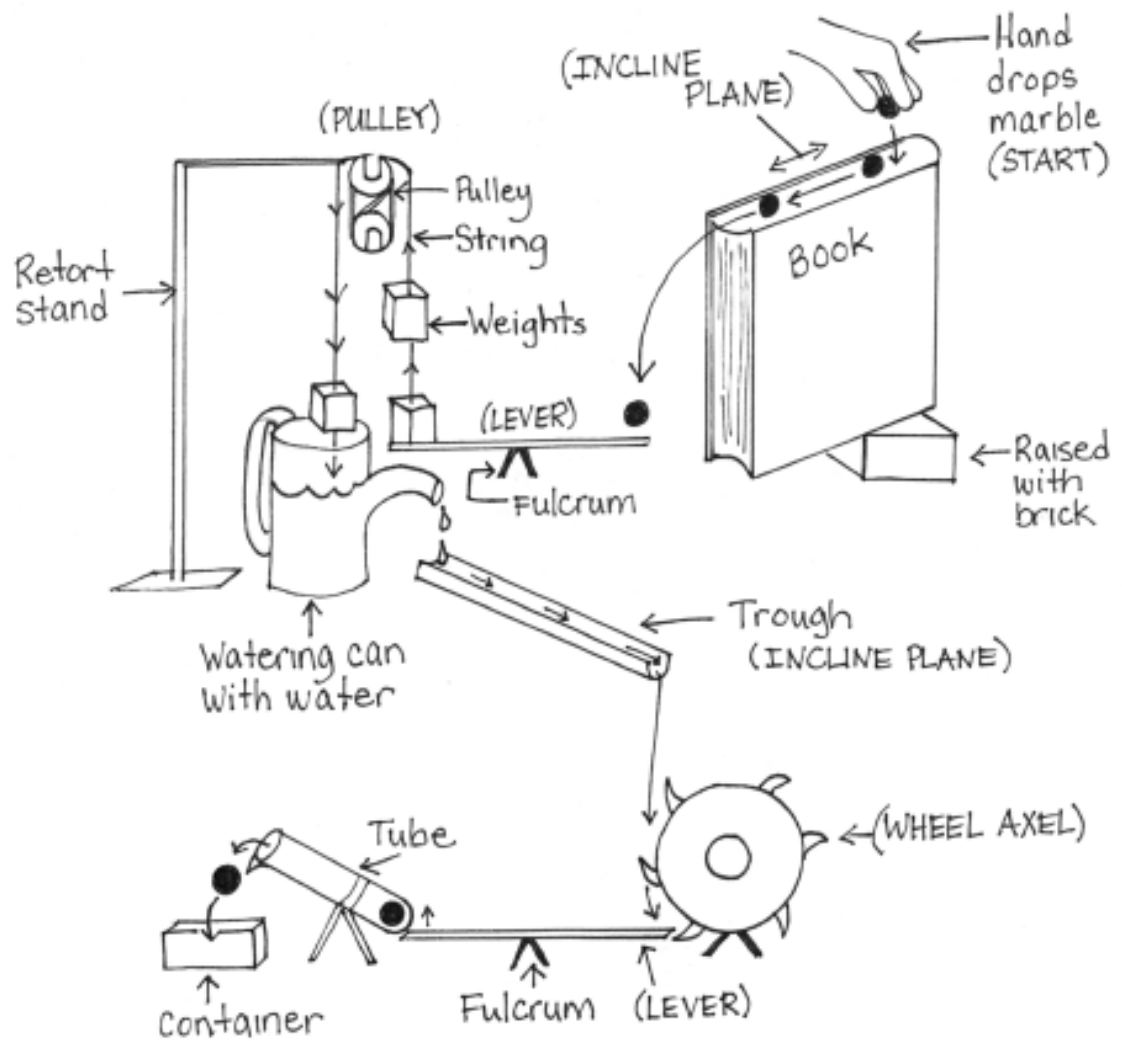
Shading or colouring is not usually found on scientific drawings. If you want to indicate a darker area, you can use stippling (a series of dots).

Label the following: Title (name of device), Date, Team Name, Time it takes to extract the marble.

Time from start to finish: _____seconds.

Team Worksheet 5b – Sample Scientific Drawing

WATER EXTRACTOR



TEAM NAME: The Extractors
DATE: February 1, 2007

TIME: 45 SECONDS

Team Worksheet 6 – Presentation

Clearly communicating your ideas to others is a very important part of being an engineer. As part of the challenge, your team must make a 1-2 minute video about your device. Each person on your team must participate in the video. Below is a sample outline of the topics to be covered.

Plan for the presentation to the judges – it is a critical component of where you get marks from the judges!

- Decide who will do each section of the presentation.
- Brainstorm ideas to include in each section
- Each team member should prepare one part of the presentation.
- Make sure you show your machine in action.
- Practice your presentation to be sure you have included all of the required information.
- Judges will be awarding points for presentations.

SPEAKER 1: Introduce your team and the device. Explain how your team came up with the concept and design.

SPEAKER 2: Explain the steps of the device. What are the simple machines you used?

SPEAKER 3: Discuss the forces on each of the different simple machines you used. (not on all machines – one of each type)

SPEAKER 4: Which parts of the device worked well? What would your team change if they could do the challenge again?
