PERFORMANCE TASK: RESCUE MACHINES

Situation:

There had been another **major typhoon**. The devastation is catastrophic. Roads have been washed out and bridges have collapsed. Planes and other aircraft cannot fly due to strong winds. The Power grid is out. Use of heavy equipment is out of the option as roads are badly damaged.

As the first response unit, you are tasked to **provide relief** and **rescue** to affected communities. You will need to **move materials/supplies** from the command post to the affected areas. To ensure effective and efficient operations, you as the team leader need to form a team of specialists. Disaster relief agencies around the world will be monitoring the relief efforts. Aside from providing relief, your goal is to present effective plans for **quick access to remote areas** which can serve as a model for future disaster response.

Task:

You need to **deliver** much needed **food** and **medical supplies**. You have been "commissioned" to design machines that will carry the goods up to the mountains, across rivers, and rugged terrain.

Each member of your team will design and build a machine for each specific task.

TASK	Origin and destination	Description	Assigned To
1	Warehouse to Base Camp	Across flat land	
2	Base Camp to Summit 1	Up a hill	
3	Summit 1 to Summit 2	Hill top to another	
4	Supplies Across Water	Across water	
5	Supplies down to Village	Down to the village	

REQUIREMENTS:

1. The individual machine must be a combination of at **least 2 simple machines**. However, a combination of 3 or more simple machines is required to achieve an exemplary rating.
2. The combined **mechanical advantage** of the machine must be **at least 4**.
3. The individual **machine must be different** from the other machines in your group. (e.g. When using pulleys, use a combination of different pulley systems.
4. Each group is allowed to use one **(1) wooden board/ramp**. However, this should only be in support of the

main machine that will move the load up or down a hill.

TIMELINE:

DAY	SPECIFIC TASK	DESCRIPTION/NOTES	✔
1	Brainstorm ideas and complete design plan	-Labeled diagram of machine -List of materials needed for build	s
2	Design and build	-Check if machine satisfies ALL the requirements -Individual test must include measurements needed to calculate Work, Power, and Mechanical Advantage (Actual/Ideal)	s
3	Complete build/revisions; individual testing of machine		
4	Complete testing/calculations; organization of individual poster	-Individual poster completed; refer to layout -Requirement for individual test: **4 points**	s
5	Group Test	-Requirement for group test: **3 points**	s

REVIEW OF CONCEPTS

How do you increase the mechanical advantage of these simple machines?	
Lever	
Inclined Plane	
Wedge	
Screw	
Pulley	
Wheel and Axle	

DESIGN PLAN

Assigned Task	Describe the work that needs to be done.
identify the simple machines needed for your **RESCUE machine**.	**Description** of the simple machine and its **contribution** to the whole machine.
LABELED DIAGRAM OF RESCUE MACHINE (Draw sketches of ideas in your notebook.)	
LIST OF MATERIALS:	

INDIVIDUAL TESTING OF RESCUE MACHINE

CALCULATIONS:

WORK in Joules W= F x d	CALCULATED: Force (N):2 Distance (m):1 Work (J):2	ACTUAL: Force (N):2 Distance (m):1 Work (J):2
POWER in Joules P= W/T	Work (J): 1 Power (w):0.027	Time (s):37
Mechanical Advantage	Ideal Mechanical Advantage	Actual Mechanical Advantage MA= Load/Effort
Simple Machine 1 Pulley	25/12.8 = 1.953	Load: 25g Effort Force: 0.25 N MA: 2 Effort Distance: .72 Meter
Simple Machine 2 **Crank (couldn't measure)**		Load: Effort Force: MA: Effort Distance:
Simple Machine 3 **Ramp**		Load: 25g Effort Force: 0.25 MA: Effort Distance: 1

INDIVIDUAL POSTER ON RESCUE MACHINES CHECKLIST

DESIGN	CRITERIA	
1. **Labeled** diagram of the RESCUE MACHINE (appearance) and **materials** to be used	All part/materials labeled	
	Accurate and detailed representation of simple machine; includes accurate labels for all forces and distances	
2. Used **appropriate techniques** to provide an accurate drawing of machine	Drawings done with clear, thin lines and eraser marks are not visible	
	All labels are ruler drawn	
	Drawings and text show well balanced design; layout very easy to read	
	Effective use of color/no color that enhances the information on the poster	
SCIENCE		
Description of the machine (how it works)	Very detailed description of the device used to move the supplies	
	Supports with calculations of work, power and mechanical advantage (includes a comparison of the Ideal and Actual mechanical advantage)	

Performance Task Rubric: Rescue Mission Machine

CRITERIA	Exemplary 7	Proficient 5	Developing 4	Emerging 1
Achievement: Communication Design **Labeled** drawing of the **design** (appearance) and **materials** to be used	- Has used appropriate techniques to provide an accurate drawing of the machine - Includes accurate labels for effort and resistance (Load) forces and distances - Drawings and text show well balanced design; layout very easy to read	- Has used mostly appropriate techniques to provide an accurate drawing of the machine - Incudes labels for effort and resistance (Load) forces and distances with few inaccuracies -Drawings and text show balanced design; layout mostly easy to read	- Has used some appropriate techniques to provide an accurate drawing of the machine -Includes labels for effort and resistance (Load) forces and distances with several inaccuracies -Drawings and text show somewhat balanced design; layout makes it somewhat difficult to read	- Has used few techniques to provide an accurate drawing of the machine -Attempts to label forces and/or distanc -Drawings and text unbalanced; layout makes it very difficult to read
Achievement: Knowledge and Understanding Explains how the machine provides a mechanical advantage	**-** Very detailed explanation of how the device reduces effort (makes work easier); supported by calculations of work, power and mechanical advantage -A comparison of ideal (expected) and actual mechanical advantage is included	- Satisfactory explanation of how the device reduces effort (makes work easier), supported by calculations of work, power, and mechanical advantage	- Basic explanation of device used with limited detail and little/inaccurate support with calculations of work, power, and mechanical advantage	- Explanation of device is incomplete and lacks supporting calculations
Learning Habits: Collaboration	Device completes task successfully All team members participate in decision-making, problem-solving and construction	Device is built and mostly completes task Most team members participate in decision-making, problem-solving and construction	Device completes the task successfully but breaks down after testing Some team members involved in decision-making, problem-solving and/or construction	Device is built and partially completes the task Most of the work and decision-making is done by a few.