

Quiz #1 Review Practice Problems

1. What are the 6 steps of the engineering design process? →
2. Give an example of how the design process is iterative?
 - At the end of each step of the design process, the user should check to verify that the results are successful. If not the user needs to return to a previous step and repeat. The design process is a constantly repeating cycle.
3. What is energy and how is it measured?
 - The stuff that makes stuff do stuff
 - The ability to do work
 - The potential to create change in a system
4. How would I calculate the work done by my car when I drive it to school?
 - Force generated by the car times the distance the car traveled.
5. How does a crow bar demonstrate the purpose of a simple machine?
 - A crow bar magnifies the force of the user pressing down to the end of the crow bar to lift an object or nail. This requires that the user apply the force over a greater distance than the output lifting force.

Design Process

1. Define the Problem
 - a. Define the criteria to solve the problem?
 - b. Conduct Research - Explore, research, investigate
2. Generate Ideas/ Brainstorm
 - a. Evaluate or rank ideas
 - b. Choose a solution
3. Develop a Solution
 - a. Create a detailed plan for developing a specific solution
4. Construct & Test Prototype
5. Evaluate Solution
 - a. Does the solution solve the original problem?
 - b. Check the problems criteria and constraints
6. Present the solution.

6. Please list the 6 types of simple machines and an example for each.

Simple Machine	MA<1	MA=1	MA>1
Lever	Chop sticks	Teeter totter	Pry bar
Wheel and Axle	Bike wheel		Steering wheel
Wedge	???	Wedge w/ height=width	Door stopper
Inclined Plane	Cliff	Slope = height	ramp
Screw	none	???	Bolt
Pulley	F _E applied to movable pulley	Non movable pulley	Crane

7. What type of lever is a pair of pliers?
 ○ Class 1 -
8. Explain what it means if the pair of pliers are described as having a mechanical advantage of 4.
 - The users effort of squeezing the handles and creates four times the force on the squeezing end of the pliers that are grabbing something

9. Draw an example of a pulley that would give an MA of 6.

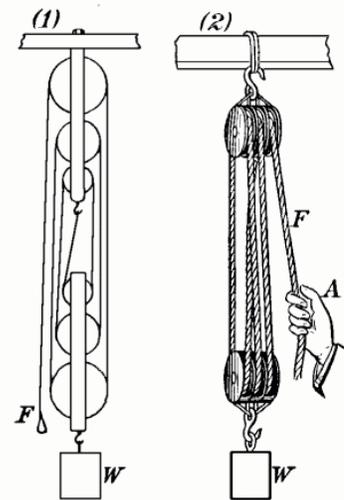
○ See picture →

10. How big does a steering wheel for a car need to be if it needs to generate 40 lbs of force on a 2in diameter axle when the driver applies 8 lbs of force?

○ 10 in

11. A hospital needs to build a wheel chair ramp that leads to the front entrance. Ideally 200lb patient should be able to go up the ramp in a wheel chair with only 20lbs of pushing force. If the entrance is 6 ft above the sidewalk, how far away from the entrance do contractors need to start building the ramp?

○ 59.7ft



12. A toy catapult is used to launch a marble with a force of 10 Newtons. The rubber band above the crossbar provides a force of 15 Newtons. If the catapult arm has a total length of 25cm. Where should the rubber band be place to generate the necessary force? (Assume ideal conditions)

- $AMA = F_R / F_E = 10N / 15N = 0.67$
 ○ $IMA = AMA \rightarrow d_E / d_R = 0.67 \rightarrow (d_E / 25cm) = .67$
 ○ $d_E = 16.7$ in from the fulcrum

