name _____ class ____ team ___ seat ___

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Our goal is to identify and understand the Class 1 lever.

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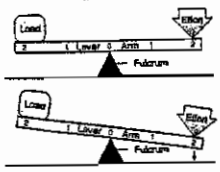
Standard 5Gd, 5Ic

CLASS-1 LEVERS

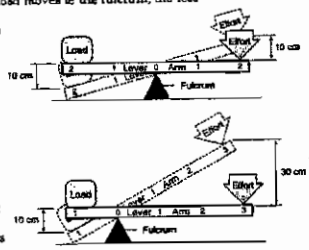
The *lever* is one of the simplest machines and also one of the most common. The lever is a rigid beam that can pivot at a fixed point. We call the beam the *lever arm*, and the fixed point is the *fulcrum*. The object to be moved or the resistance to be overcome is the *load*. The amount of force exerted to move or overcome the load is the *effort*.

The lever can be set up in different ways. A *class-1 lever* has the fulcrum located somewhere between the effort and the load. With this kind of lever, the direction of force is changed. Effort applied downward moves the load up. Effort applied upward moves the load down.



If the distance from the fulcrum to the load is equal to the distance from the fulcrum to the effort, there is no mechanical advantage. You exert effort for the same distance the load moves. The force of the effort is equal to the force of the load.

If the load is moved closer to the fulcrum, you gain a mechanical advantage. It now takes less effort to lift the load. In fact, the closer the load moves to the fulcrum, the less effort it takes to lift the load. But there is a cost. As the load moves closer to the fulcrum, the effort must move a greater distance, and the load is lifted a shorter distance. You trade reduced effort for increased distance.



Think how difficult it would be to pull a nail out of wood with muscle power alone. The job becomes simple with a claw hammer. The claw hammer is a class-1 lever. The handle and the claw of the hammer work as the lever arm. In this case, the lever arm is not straight, but curved. The fulcrum is the top of the hammer head. It rests against the wood. The nail is the load (in this case, a resistance to be overcome). Although you push the handle for a greater distance than the claw moves, you don't need as much effort to pull the nail. Imagine two claw hammers, one with a long handle and one with a short handle. Which hammer would pull the nail with less effort?

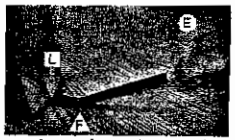
A claw hammer acts as a class-1 lever when used to pull a nail.

Other class-1 levers include the crowbar and the tack puller. Can you see where the load and the fulcrum are and determine where the effort is applied?

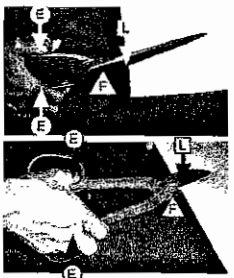
Class-1 levers can be joined. Two levers working together form a *double lever*. The fulcrum is the place where the levers cross. Examples of double class-1 levers are scissors and tin snips, which are shears for cutting metal. The levers work together to apply pressure. The load is a material's resistance to the cutting blades.

Double class-1 levers offer an advantage of either distance or effort. When you cut through paper with long-bladed scissors, you gain distance. The short, looped handles are moved a small distance while the blades cut through a long distance.

Using tin snips, you gain effort. The long handles move a greater distance than the short blades do. That gives you enough power to cut through metal. Pliers and bolt cutters are double levers, too. What kinds of advantages do they offer?



A crowbar is another example of a class-1 lever.



Scissors and tin snips are examples of double class-1 levers.

How does a claw hammer make it simple to remove a nail from a piece of wood?

Describe what happens in the system as the load moves closer to the fulcrum..

bob

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