Mechanical Energy

P1 Mechanical energy is often confused with Kinetic and Potential Energy. Before discussing the difference it is important to understand the word 'Work'.

P2 'Work' is done when a force acts on an object to cause it to move, change shape, displace, or do something physical. For, example, if you push a door open for your pet dog to walk in, work is done on the door (by causing it to open). But what kind of force caused the door to open? Here is where Mechanical Energy comes in.

P3 Mechanical energy is the sum of kinetic and potential energy in an object that is used to do work. In other words, it is energy in an object due to its motion (kinetic) or position (potential), or both. In the 'open door' example above, you possess potential chemical energy (energy stored in you), and by lifting your hands to push the door, your action also had kinetic energy (energy in the motion of your hands). By pushing the door, your potential and kinetic energy was transferred into mechanical energy, which caused work to be done (door opened). Here, the door gained mechanical energy, which caused the door to be displaced temporarily. Note that for work to be done, an object has to supply a force for another object to be displaced.

Consider the example of a boy with an iron hammer and nail. In *Illustration1* below…

(1) The iron hammer on its own has no kinetic energy, but it has some potential energy (because of its weight).
(2) To drive a nail into the piece of wood (which is work), he lifts the iron hammer up, (increasing the potential of the hammer due to its high position)
(3) and force it to move at great speed downwards (now the hammer has kinetic energy) to hit the nail.
The sum of the potential and kinetic energy that the hammer acquired to drive in the nail is called the Mechanical energy, which resulted in the work done.

All Work and No Play

P4 Work, work, work. You might head off to your job one day, sit at a computer, and type away at the keys. That's all we do here. Is that work? To a physicist, only parts of it are. Work is done when a force that is applied to an object moves that object. The work is calculated by multiplying the force by the amount of movement of an object (W = F x d). A force of 10 Newtons, that moves an object 3 meters, does 30 nm of work. A newton-meter is the same thing as a joule, so the units for work are the same as those for energy – joules.

P5 Sitting and looking at a computer screen is not work. Tapping on the keyboard and making the keys move is work. Your fingers are applying a force and moving the keys. Driving to your job is not work because you just sit, but the energy your car engine uses to move the car does work. You have to exert a force AND move something to qualify as doing work.

P6 Imagine that you are holding a brick above the ground. Your arm is straight out in front of you and it's pretty tough to hold. Slowly, your arm gets tired, the brick feels heavier and heavier, and you finally have to stop to let your arm rest. Even though you put forth a lot of effort to hold the brick up, did you do any work on the brick? Nope. The brick didn't move. No work was done if no movement happened. If you lifted the brick again after your arm had rested, that would be work.

All Work and Some Play….

P7 There is more than one way to get the same amount of work done. Consider *Illustration 2* below. Both men are moving the same load into same truck. However, one of them is able to do it with less force. How is that possible?

Artilcles modified:
"Kinds of Energy." eSchool Today http://www.eschooltoday.com/energy/kinds-of-energy/what-is-mechanical-energy.html
"All work and no Play." Physics 4kids.com http://www.physics4kids.com/files/motion_work.html

Mechanical Energy Analysis Questions:

1. ***Describe*** the specific requirements for a force to be considered "work."

2. ***Compare and contrast*** the mechanical energy of the hammer in step 1 and step 2 of the diagram. Support your response using evidence from the text.

3. Paragraph 7 contains the statement "*Driving to your job is not work*…." Using your knowledge of the world and ***evidence from the text*** to support your argument, ***explain*** why you agree or disagree with this statement.

4. Using ***evidence from the text, explain*** why one of the men in Illustration 2 struggles with loading the box on the truck, while the other does not.