Lab: To Measure the Efficiency of an Electric Motor

Question: How does the efficiency of an electric motor vary as the speed increases?

Background:
Efficiency is defined as the ratio of useful work output divided by work input. This computes out to a decimal which is always less than 1. Normally it is expressed as a percentage by multiplying the decimal by (100%), that is

Efficiency = 100% * (Useful Work Output)/(Work Input)

An electric motor converts electrical energy into mechanical energy (or work). You will determine the efficiency of an electric motor by measuring the electrical energy consumed by the motor and the amount of work done.

You will set up an electrical motor so that when power is applied it lifts a known mass through some vertical distance at a more or less constant speed. You will measure the work done (work output) by the change in potential energy of the mass. That is given by the equation
PE = (mass) * (acceleration of gravity) * (height)

The electrical energy input is given by the equation
Electrical energy (or work) = (voltage)*(current)*(time)

Procedure:

1. Draw a neat schematic diagram using the variable power supply, a button, voltmeter, ammeter, and electric motor. Set up the circuit and have the instructor approve it before applying power.

2. Push the button to turn on the motor and adjust the voltage so that the mass is lifted at a constant speed.

3. You will need to record the voltage and current while the mass is moving. (The voltage and current readings will change when it stops at the top). This requires some coordination between the lab partners. You also need to record the amount of time it takes for the mass to move from the bottom to the top. Again, it requires some coordination to get all these readings done at once. You should make several runs using the button to control when voltage is applied. DO NOT change the power supply between runs at a specific speed.

4. You will need to make runs at several different speeds (from quite slow to fast) and calculate the efficiency at each speed in order to answer the question.

5. Draw a graph with average speed on the x-axis and efficiency on the y-axis and use that to state your conclusion.

Conclusion:
As the speed increases, the efficiency (increases, decreases, remains constant, varies randomly).

Efficiency of an Electric Motor							
Mass used.....kilograms							
Voltage	Current	Time	Height	Work Out	Work In	Efficiency	Speed
(Volts)	(Amps)	(Seconds)	(Meters)	(Joules)	(Joules)	0%	M/Sec