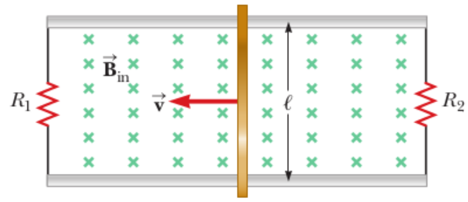
Name: ________________________________

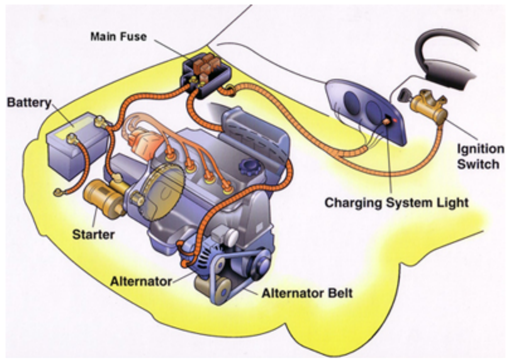
> Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.



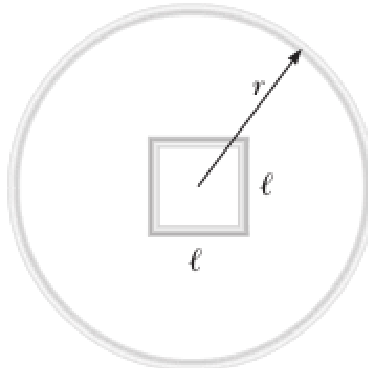
1\.

A conducting rod of length $\ell = 35.0$ cm is free to slide on two parallel conducting bars as shown in the above figure. Two resistors $R_1 = 2.00\Omega$ and $R_2 = 5.00\Omega$ are connected across the ends of the bars to form a loop. A constant magnetic field $B = 2.50T$ is directed perpendicularly into the page. An external agent pulls the rod to the left with a constant speed of $v = 8.00\frac{\text{m}}{\text{s}}$. Find (a) the currents in both resistors, (b) the total power delivered to the resistance of the circuit, and (c) the magnitude of the applied force that is needed to move the rod with this constant velocity (this force will be opposite of the magnetic force on the rod).

2. This is a great question because now you can begin to understand the physics behind how your car's engine provides power to the car and the battery and your phone.



In a 250-turn automobile alternator, the magnetic flux in each turn is $\Phi_B = 2.50 \times 10^{-4} \cos \omega t$, where Φ_B is in **webers** (you have read the texbook, right?), ω is the angular speed of the alternator, and t is in seconds. The alternator is geared to rotate three times for each engine revolution. When the engine is running at an angular speed of 1.00×10^3 rev/min, determine (a) the induced emf in the alternator as a function of time and (b) the maximum emf in the alternator. (c) How does this compare to the voltage required by many electronic devices (say, five volts).



3.

A square, single-turn wire loop, $\ell = 1.00$ cm on a side is placed inside a solenoid that has a circular cross section of radius $r = 3.00$ cm as shown above. The solenoid is 20.0 cm long and wound with 100 turns of wire. (a) If the current in the solenoid is 3.00 A, what is the magnetic flux through the square loop? (b) If the current in the solenoid is reduced to zero in 3.00 s, what is the magnitude of the average induced emf in the square loop?