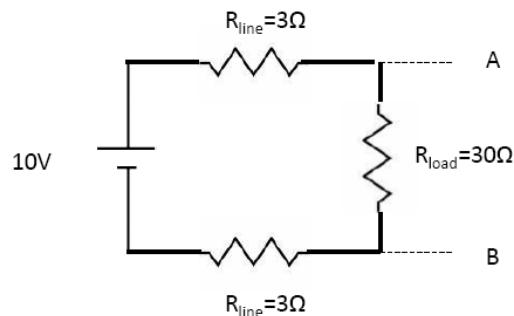


Assignment #5 Physics 346

Due 4:30 pm **Friday** March 2, 2012

Use Phys 346 drop box located at entrance to Physics Dept. off main floor of AQ.

1. There is a proposal to build a 3000 km HVDC transmission line from North Africa to Europe to deliver solar electricity from the desert (DESERTEC project). Assume the power delivered to Europe is 5GW and the delivered voltage at the European end is 800kV.
 - (a) What diameter of copper cable is required to ensure that the resistance power losses in the transmission line are below 10
 - (b) What voltage must be generated in Africa to account for the voltage "dropped" across the transmission line conductors?
2. An electric car requires 20 kWh of electrical energy to travel 100 km. The car must have a driving range of 400 km on a full charge. It is designed to run on Pb acid batteries which have a voltage of 12 V and a charge capacity of 90 A-hr.
 - (a) What is the total stored charge required to achieve this range?
 - (b) How many batteries will be necessary to achieve this range?
3. The circuit below is a simple model of a fictitious town that runs on low voltage DC power. The power is generated by a DC power facility at a voltage of 10V and deliver by two power lines with resistance R_{line} . The maximum power the voltage source can deliver is 5 W.



- (a) Find the total power delivered by the DC voltage source.

- (b) Find the power lost to resistance heating in the wires.
 - (c) It is proposed that a second town of resistance $30\ \Omega$ be connected in parallel to the town (across points A and B in the diagram). Will this be possible given the maximum power that the voltage source can supply?
4. Near the surface of the earth the electric potential V decreases by $\approx 120\ \text{V}$ for every meter of elevation increase.
- (a) What is the magnitude and direction of the electric force on a $10\ \text{nC}$ charge near the surface of the earth?
 - (b) (1 marks) Why do humans not observe this voltage in everyday life? (After all, 110V from an outlet can kill)
5. Questions from your text:
Ch 7 Problems #16, 17, 20