

Physics 115A Answers to assigned questions from chapter 21, Giancoli

1. The effect is magnified, because each turn independently generates an induced current.
2. Magnetic flux measures the flow of the number of field lines through a surface: $\Phi_B = BA \cos \theta$. Hence, it depends on the relative orientation of the field and the surface. Flux can be zero even for a very large field if the field line is properly oriented (but not vice versa).
5. Left loop: There is no change in magnetic flux through the loop and therefore no induced current. (However, this is a moving conductor in a magnetic field. The free charges in the conductor will experience a magnetic force, which will cause a charge separation. There will be a current only while this separation is being established. See Ex. 21-4.)
7. The small separation reduces the area of the loop containing both wires as boundaries, and so minimizes induced emfs.
9. When an appliance starts, it draws current that didn't flow before. This changes conditions in the circuit, inducing currents. So at the start, the current surge causes the house's voltage to drop, dimming the lights. After the motor speeds up, the back emf in the motor has increased and the motor will draw less current. Because there is no back emf in an electric heater, the heater will draw a large current as long as it is on.
12. Any metal sheet is a conductor and will experience eddy currents. These occur whether or not the metal is ferromagnetic.
14. The slotted bar reduces the size of the eddy currents that can be induced in the bar. The force retarding the metal depends on the size of the flux; a smaller flux means a smaller induced field.
18. To find out which wires are paired, one may simply connect a bulb and battery (or a number of batteries in series if needed) through the wires, pairing the wires one at a time. The bulb will light only when the two wires make a continuous path. The two paired wires may be found this way. Alternatively, one may use an ohm meter. Pairs of leads with infinite resistance are not connected, while those with finite resistance are.
Having identified paired wires, you can put in an ac voltage in one pair and measure the ac voltage induced in the other pair of wires. The ratio of the voltages gives the ratio of turns: $N_p/N_s = V_p/V_s$.
19. Higher voltages in the home might mean more deaths from accidental electrocution. This would involve lower currents in the transmission lines, saving energy in transmission, but higher currents in the home with present appliances (i.e. having the same resistance as now). Hence, there would be much more Joule heating of the wires in the home, wasting some of the savings. Most importantly, this would either require much more substantial insulation covering

the electric wires or could cause fires (this was a very real problem in the first years after electricity came into use). If new appliances designed for the higher voltage were purchased, savings would result because currents would be lower in the home, but there would be a large initial expense for conversion.