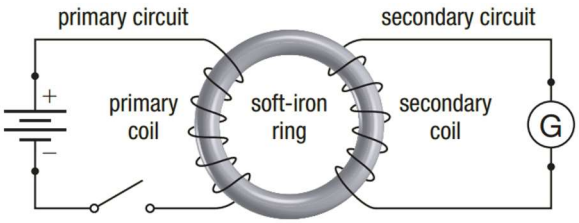
SPH3U 13.1 Electromagnetic Induction

1. Discovery

Induction:	
Chapter 12:	
Chapter 13:	
stationary magnet	
moving magnet	
Law of electromagnetic induction:	

Faraday's ring:	



2. Factors affecting induction

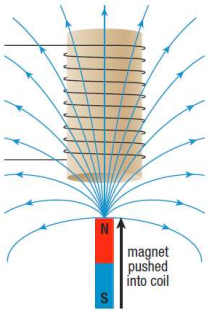
Coiled conductor:	
Number of loops:	
Change in magnetic field:	
Magnetic field strength:	

3. Applications of electromagnetic induction

Induction cooking:	
Metal detectors:	
Induction chargers:	

Homework: page 591: #2-3

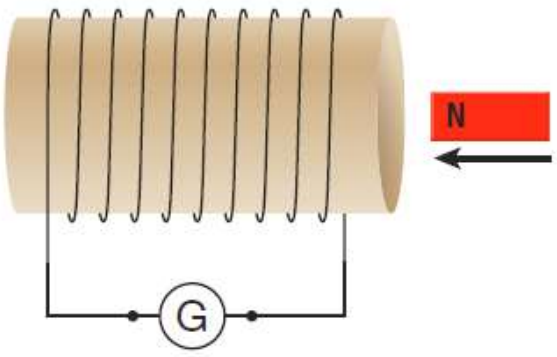
SPH3U 13.2 Lenz's Law

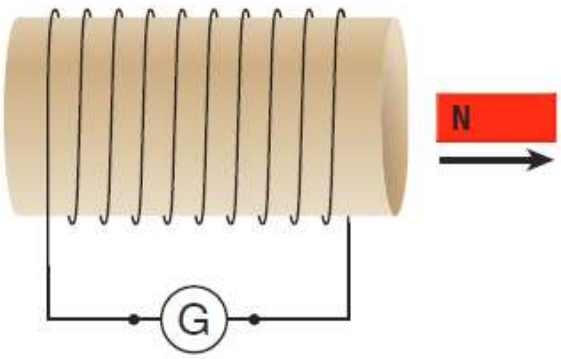


1. Direction of induced current

Lenz's question:	

Newton's 3rd law:	
applied to induced currents	
Lenz's Law:	





2. Drop-tower rides

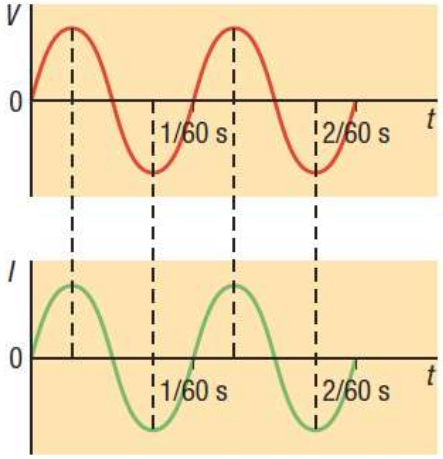
Drop-tower rides:	
brakes	
solution	

Homework: page 594: #1-3

SPH3U 13.3 Alternating Current

3. Alternating current

Continuous current:	
solution	
Alternating current:	
DC vs. AC:	
Canada's electricity:	
RMS voltage:	

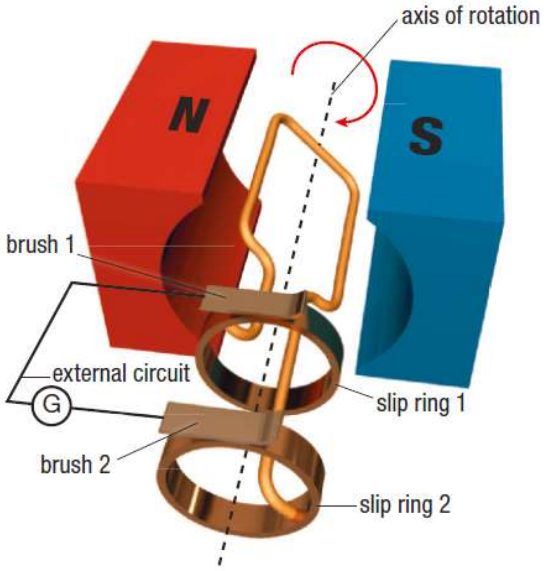


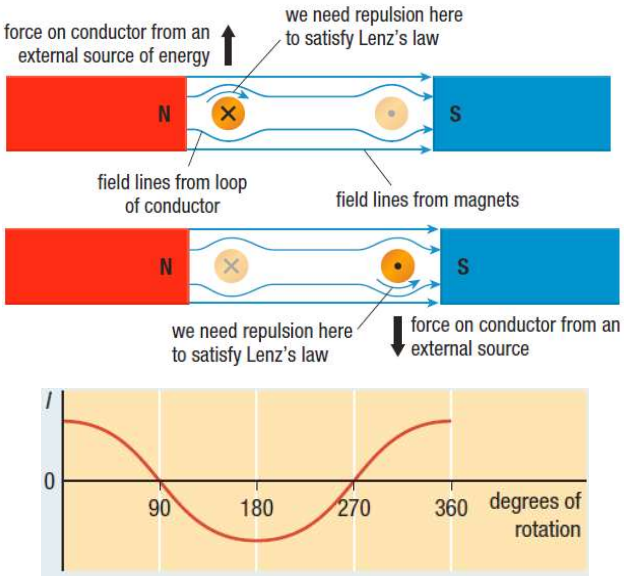
Homework: page 598: #1-2, 5

SPH3U 13.4 Electricity Generation

4. The AC generator

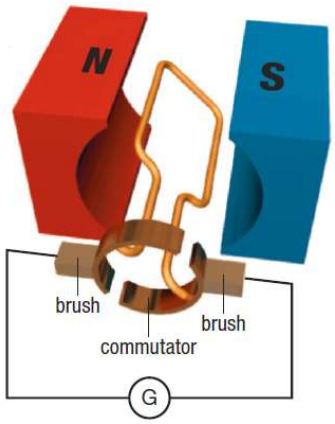
Design:	





5. The DC generator

Design:	

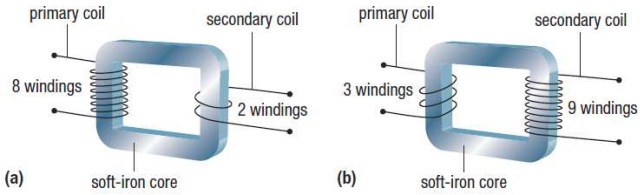


Homework: page 604: #2-3

SPH3U 13.5 Transformers

6. How transformers work

Transformer:	
AC	
how it works	



Step-down transformer:	
Step-up transformer:	
Conservation of energy:	
Equations:	

A step-down transformer used in an adapter for a laptop has a primary voltage of 120 V. There are 250 windings in the primary coil and 25 windings in the secondary coil. Calculate the voltage in the secondary coil.

A step-down transformer used in the adapter for a cellphone charger has a primary voltage of 120 V and a secondary voltage of 5.0 V. The current in the primary coil is 0.10 A. Calculate the current in the secondary coil.

Homework: page 609: #2, 7-9

SPH3U 13.6 Power Plants and the Electrical Grid

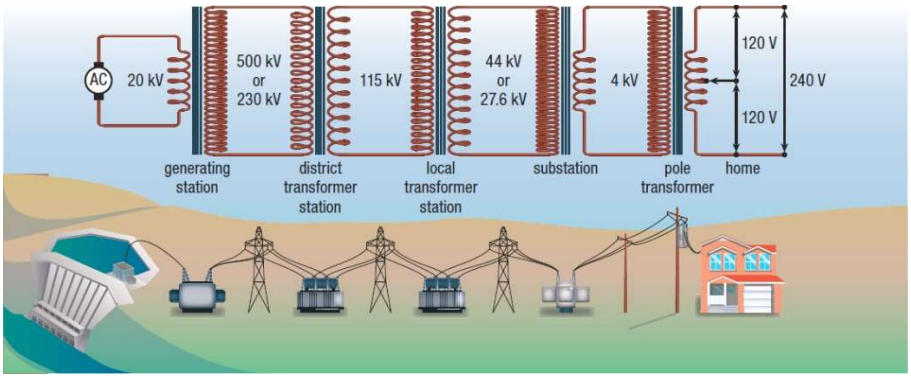
7. Transmission efficiency

Power loss:	
equation	
efficiency	

A generator produces 300 MW (3×10^8 W) of power at a current of 30 kA and a voltage of 10 kV. That power travels through a transmission wire with a resistance of 0.1 Ω. How much power is lost (in MW and in % of the total)?

Now a step-up transformer is used to increase the voltage to 100 kV before sending it over the wire. This lowers the current to 3 kA ($V_P I_P = V_S I_S$). What is the new power loss?

8. The power grid



AC generators:	

Homework: page 612: #1-2