Flux:



* φ = flux (measured in Webers, Wb)
* A = area (m2)
* B = magnetic field (Tesla, T)

Faraday’s Law:



* V = potential (V)
* N = number of turns (no units)
* Δφ = change in flux (W)
* Δt = change in time (s)

Transformers:



1. Billy is pedaling his bike down the street perpendicular to Earth’s magnetic field of 5.5\*10-5 T. What is the flux through the metal rim of his bicycle wheel, if the wheel has an area of 1.13 m2?
2. If the bicycle in question 1 takes 2.0 s to make a 90° turn onto a northbound street, what is the induced voltage in one metal rim of the bicycle?
3. While out for a walk with his mother, Lance notices a large, cylindrical gray box high atop a telephone pole. His mother explains that it is a transformer. This transformer takes 6000 V from the power company and steps it down to the 240 V supplied to each of the houses on the street, with the use of a secondary coil containing 100 turns. How many turns are there in the primary coil?
4. Robert is undergoing an MRI procedure and is placed inside a chamber housing the coil of a large electromagnet that has a radius of 30.0 cm. A flux of 0.350 Wb passes through the coil opening. What is the magnetic field inside the coil?
5. Patty is driving down the expressway on her way to the office in a town where the horizontal component of Earth’s magnetic field is 3.5 x 10-5 T to the north. The driver’s side window of Patty’s car has an area of 0.40 m2.
   1. What is the magnitude of the flux through the window if the car is moving south?
   2. How does it differ if the car is moving west?
6. Becky wears glasses whose wire frames are shaped like two circles, each with an area of 2.0 x 10-2 m2. The horizontal component of Earth’s magnetic field in Becky’s hometown is 1.9 x 10-5 T. If Becky turns her head back and forth, rotating it through 90°every 0.50 s, what is the induced voltage in the wire frame of one eyepiece?
7. Audrey disassembles the control box of her electric train and finds a small transformer inside. Its primary coil is made up of 600 turns and the secondary coil is made up of 60 turns.
   1. If the household voltage supplied to the train is 120 V, what voltage is required to make the train run?
   2. Is this a step-up or a step-down transformer?
8. A hydroelectric plant in Niagara Falls transmits electricity at 3000 V to the transformer in a substation that steps it up to 120,000 V for transmission to homes in New York City. If the primary coil contains 2000 turns, how many turns are there in the secondary coil of the step-up transformer?

ANSWERS:

1. 6.2 x 10-5 Wb 2. 3.1 x 10-5 V 3. 2500 4. 1.2 T 5. 1.4 x 10-5 Wb 6. 7.6 x 10-7 V 7. 12 V, down 8. 80,000