

Physics 251 Test 4**Name:** _____

- Show all of your work.
 - Read the entire exam before starting.
 - Calculators are allowed on this exam.
1. A circular loop of wire having a diameter of 10.0 cm is placed in a uniform magnetic field of 0.5 T with the normal of the loop parallel to the magnetic field. The loop is then rotated through an angle of 90° in 2.0 s. What is the induced emf in the loop?

2. A conducting rod of length 0.5 m slides along a frictionless table at a constant velocity 1.5 m/s . A uniform magnetic field of 0.75 T is normal to the surface.
- (a) What is the induced emf in the rod?
 - (b) How much force is required to keep the rod sliding at a constant velocity?
 - (c) How much power is delivered to the rod?

3. A battery, an inductor, a resistor, and a switch are wired in series. The inductor produces a back emf of 1.0 V when the current through it is changing at a rate of 25.0 A/s . The battery produces an emf of 1.5 V and the resistor is 5.0Ω .
- (a) What is the time constant for this circuit?
 - (b) How much current flows 0.002 s after the switch is closed?
 - (c) After the switch is closed for a very long time, what is the voltage across the inductor?

4. (10 points) Bonus: An automobile weighing 2000 lbs travels due west at a constant speed of 70 mph. The magnetic field in the area is a constant $2.5 \mu\text{T}$ due north. Unusual circumstances cause the car to gain a net negative charge of 1.0 MC. What is the normal force on the car?