

Name:

1) CLASS(2)

Joseph Henry releases a loop with resistance R , length L , width W , and weight mg in a magnetic field. There is no magnetic field at the area $y < 0$ and at $y > 0$ the magnetic field is B , as shown in fig. 1. There are three intervals which Joseph separates, (i) the whole loop is inside magnetic field; (ii) loop is partially inside magnetic field; (iii) the whole loop is under x-axis. Find current direction and magnetic force direction during these intervals. **[3 pts]**

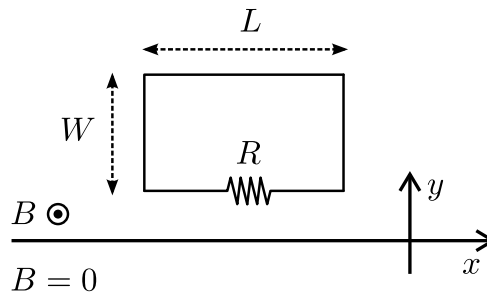


Figure 1: A loop falling down.

2) CLASS(2)

Heinrich Lenz puts a wire on the table, carrying a current I . He then takes two copper rings and moves them as shown in fig. 2. Show the direction of induced currents on these rings. Explain your answer briefly. **[4 pts]**

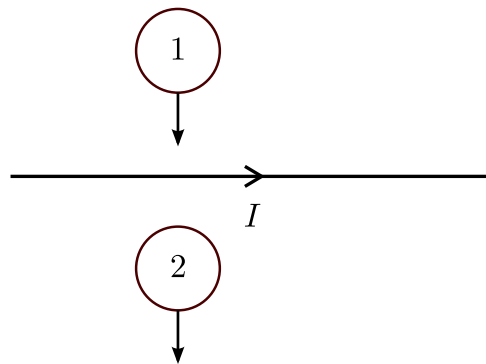


Figure 2: A wire and two copper rings.

3) CLASS(2)

Oliver Heaviside operates a motor by $V = 120$ V. He measures the starting up current to be $I_0 = 12$ A. When the motor reaches its normal angular speed, $\omega_n = 600$ rpm, it draws a current $I_n = 2.0$ A.

- Find the resistance of the armature coil. **[1 pt]**
- Find the back emf at normal speed. **[2 pts]**
- Find the back emf, current, and torque as a function of angular speed ω . **[2 pts]**