A wire loop of height $h$ and width $w$ moves from a region with no magnetic field into a region with a constant and uniform magnetic field pointing into the page, as shown in the figure.

The wire loop is shown at two instants in time, $t = t_0$ and $t = t_0 + \Delta t$.

1. For the time interval shown, does the magnitude of the magnetic flux through the loop due to the external field increase, decrease, or remain the same? Explain in one sentence. [Hint: In the two instances how much area of the loop is in the region where the magnetic field is present?]

2. Use Lenz’s law to determine whether the induced magnetic field at the center of the loop is into the page, out of the page, or zero. Explain your reasoning in one sentence.

3. Based on the direction of the induced magnetic field, what is the direction of the induced current in the loop?

4. At time $t = t_0$, how much area of the wire loop is inside the region where the constant magnetic field is present?

5. At time $t = t_0 + \Delta t$, how much area of the wire loop is inside the region where the constant magnetic field is present? [Hint: Look at the left most edge of the wire loop. Recall that the wire loop moves with a velocity $v_0$ to the right.]

6. How much has the magnitude of the magnetic flux through the wire loop changed? [Hint: Recall the magnetic field remains constant. It is only the area of the wire loop that is inside the magnetic field that has changed in time $\Delta t$.]

7. Calculate the magnitude and direction of the emf induced in the wire loop due to its motion into the magnetic field region. Write your answer in terms of $B$, $w$, $h$, $x$ and $v_0$, as appropriate. [Hint: Use Faraday’s law.]