ECE343 Spring 2025

Objective 8.1: Displacement Current



SCHEDULE

Lesson	Topics	Reading	Notes
24	BVP (Capacitor, Coax), Electric Potential	5.16	LO 5.3
25	Electric Boundary Conditions	5.18-5.22	LO 5.4
26	BC's/Capacitance	5.23-5.24	
27	Electrostatic Lab	Lab packet	
Chapter 6: Steady Current & Conductivity			
28	Current density, Conductivity, Resistance	Ch. 6	
Chapter 7: Magnetostatics			
29	Magnetic Fields, Gauss' Law for Magnetism	7.1-7.3	LO 7.1-7.2 **GR 2**
30	Ampere's Law	7.4-7.5, 7.9	LO 7.3
31	Ampere's Law Applied	7.6-7.8	LO 7.3
32	Magnetic Boundary Conditions	7.10-7.14	LO 7.4
33	Magnetostatics Lab	Lab packet	
Chapter 8: Time-Varying Fields			
34	Faraday's Law, Displacement Current, Maxwell Eqns	8.3, 8.8, 8.9	LO 8.1
35	Faraday's Law, Displacement Current, Maxwell Eqns	8.3, 8.8, 8.9	LO 8.2-8.3
Chapter 9: Plane Waves in Lossless Media			
36	Maxwell's Equations in lossless, source-free region	9.1-9.2	LO 9.1
37	Maxwell's Equations in lossless, source-free region	9.1-9.2	LO 9.1
38	Uniform Plane Waves & Polarization	9.4-9.6	LO 9.2-9.3
39	Normal Incidence	Vol 2, 5.6-5.7	LO 9.4-9.5
40	Oblique Incidence	Vol 2, 5.6-5.7	LO 9.5
41	Oblique Incidence	Vol 2, 5.6-5.7	LO 9.5
42	Incidence Lab	TBD	LO 9.5

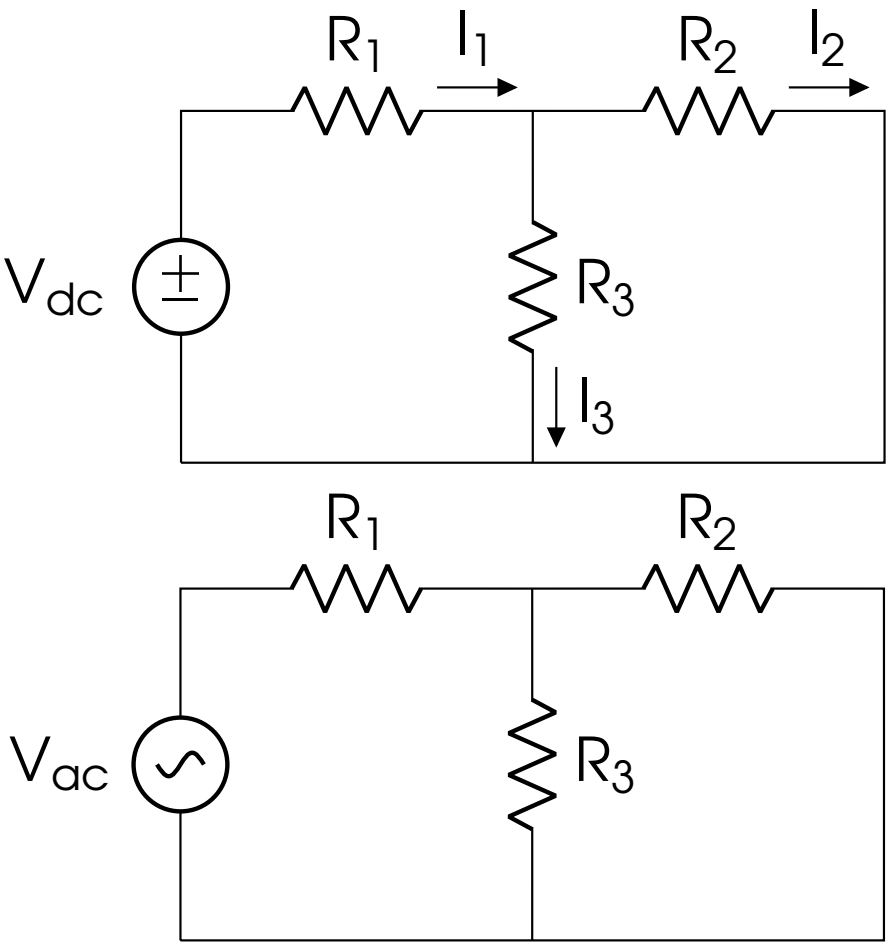
Ch 8 Learning Objectives

7.1 I can articulate the significance of the displacement current and calculate it, given a time-varying electric field.

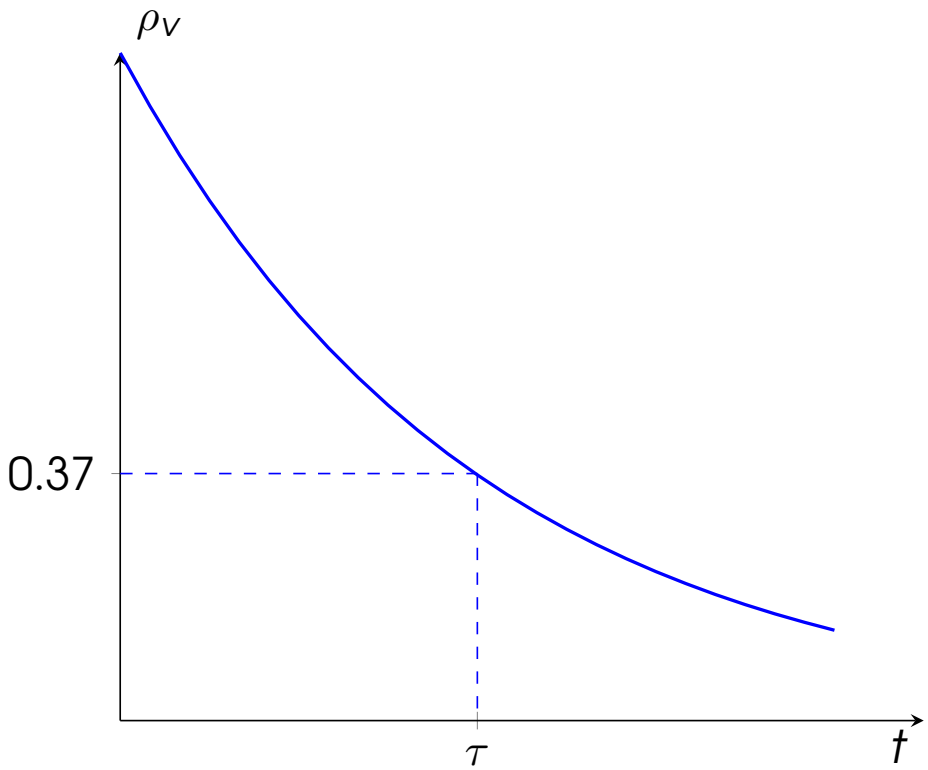
7.2 I can articulate the meaning of and calculate the relaxation time for a variety of materials.

7.3 I know the forms of Maxwell's equations for time-varying fields and use them to calculate electric and magnetic fields for a variety of physical systems.

Displacement Current



Insight #1: Relaxation Time



Relaxation Time: Examples





Polystyrene

$\sigma = 10^{-17}$S/m and $\varepsilon = 2.56\varepsilon_0$

$\tau =$

Copper

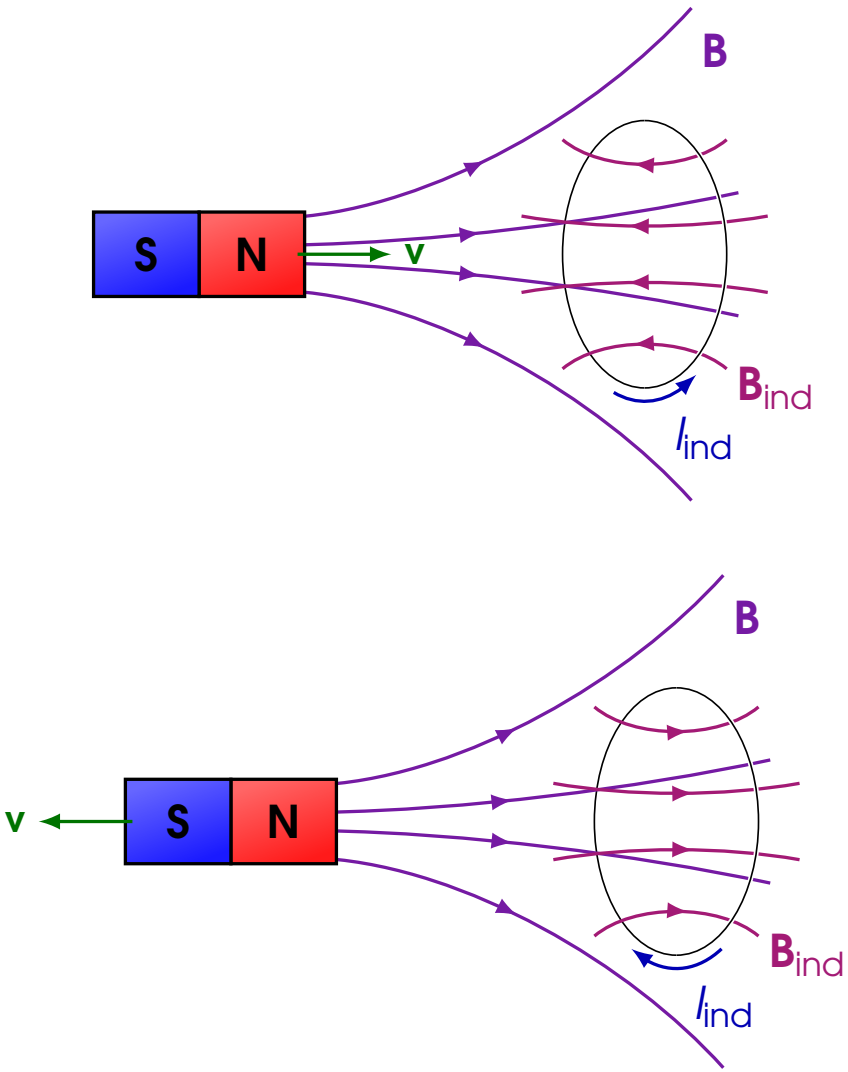
$\sigma = 5.8 \times 10^{7}$S/m and $\varepsilon = \varepsilon_0$

$\tau =$

Insight #2: Ampere's Law

Ampere's Law

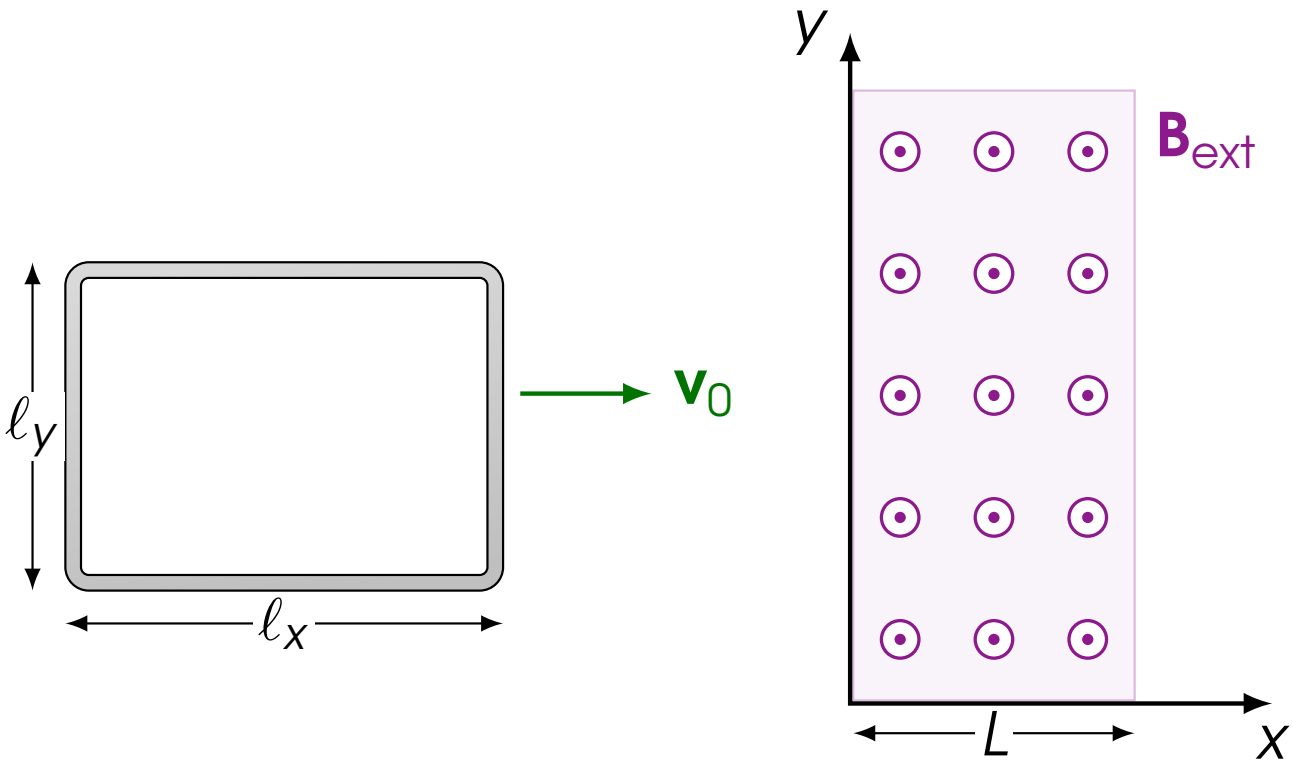
Lenz's Law



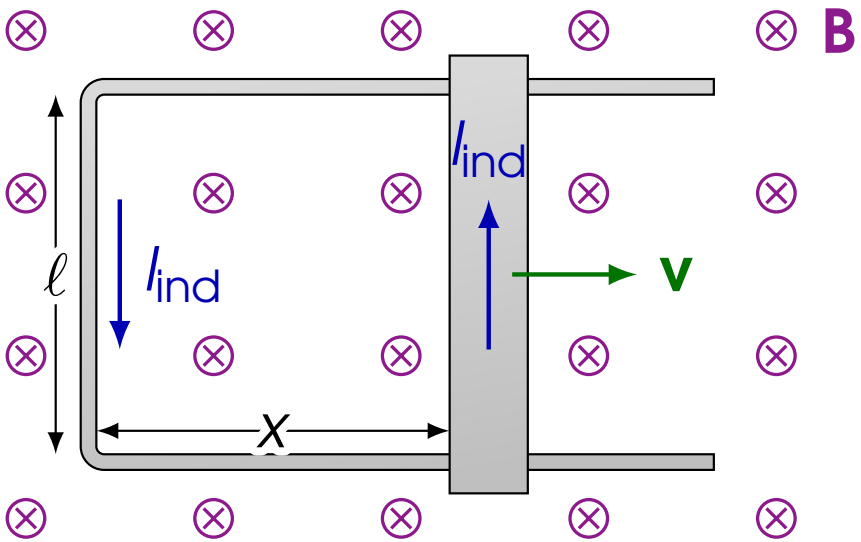
Lenz's Law

A current is induced by a change in the _____ magnetic field. The induced _____ results from an induced magnetic field opposed to the impressed _____ field.

Lenz's Law



Lenz's Law



Faraday's Law

Faraday's Law is the mathematical form of Lenz's Law:

$$V = -\frac{\partial \Psi_m}{\partial t} = -\frac{\partial}{\partial t}\iint \vec{B}\cdot\vec{dS}$$

Electric potential comes from the electric field:

Faraday's Law