

STUDY GUIDE 3

/	Objective 9	Resistance and Current	\
/			\
/	a)	Define electric current, electric current density, drift velocity, resistance, and resistivity.	\
/			\
/	b)	Given two or more simple geometric shapes of a given material, compare the resistances of the shapes.	\
/			\
/	c)	Solve problems involving interrelationships among the quantities resistance, potential difference, current, current density, electric field, resistivity.	\
/			\
/	d)	Calculate the power dissipated by a resistor carrying current.	\

Suggested Study Procedure

Study Secs. 25-1, 25-2, 25-3, and 25-5. Pay attention especially to Example 25-2. With this chapter, we officially leave electrostatics and begin to study situations where charge is made to move through the action of a source of emf, such as a battery. There are a number of new terms and physical interrelationships as indicated in the Summary at the end of Chapter 25, but the most important interrelationship is Eqn. 25.11 which states that the product of the resistance of a circuit element with the current flowing through it is equal to the voltage drop across it: $V = IR$. Equation 25.7, a vector equation, provides the justification for the conventional direction chosen for current in a wire: The direction of current in a wire is taken to be the direction that positive charges would move under the influence of an applied field.

Suggested Problems Related to Objective 9:

Chapter 25, Problems: 1, 10, 17, 22, 39, 40, 42

/	Objective 10	D.C. Circuits	\
/			\
/	a)	Given a set of resistors in a series-parallel configuration;	\
/		i) explain how current is divided among the resistors;	\
/		ii) calculate the equivalent resistance of the set.	\
/			\
/	b)	Given a circuit consisting of voltage sources and resistors;	\
/		i) calculate the current & power supplied by the sources;	\
/		ii) calculate the current through, the potential drop across, and the power dissipated by any given resistor in the circuit.	\
/		iii) calculate the potential difference between different points in the circuit	\
/			\
/	c)	Solve circuit problems involving emf and internal resistance	\

Suggested Study Procedure

Study Secs. 25-4 and 26-1, and Examples 25-8, 26-1 and 26-2 which show how a complicated circuit can be simplified to become an equivalent circuit with a single resistor and single source of emf.

Suggested Problems Related to Objective 10:

Chapter 25: Problems 28, 31, 32

Chapter 26: Problems 4, 5, 13, 15, 16, 17

/	Objective 11	Multiloop and RC Circuits	\
/			\
/	a)	Solve multiloop circuit problems using Kirchhoff's Rules.	\
/			\
/	b)	Solve circuit problems involving resistor-capacitor combinations	\
/			\

Study Sec. 26-2, and Examples 26-3 through 26-7. There are other methods of solving multiloop circuits (as ECE students will learn), however Kirchhoff's Rules represent the most fundamental as they embody conservation of charge (the Junction Rule) and conservation of energy (the Loop Rule). We will briefly discuss electrical instruments in lecture, so you can take a look at sec. 26-3 if you are interested. Read section 26-4 on circuits with both resistors and capacitors.

Suggested Problems Related to Objective 11:

Chapter 26, Problems: 25, 26, 27, 28, 40, 41, 64, 74

/	Objective 12	Magnetic Forces	\
/			\
/	a)	For two vectors given in $i j k$ notation, calculate the vector product (cross product).	\
/			\
/	b)	Given the charge, mass, and initial velocity of a particle traveling through specified electric and magnetic fields, determine the force on the particle and its acceleration.	\
/			\
/	c)	Analyze the circular motion of charged particles moving in a magnetic field.	\
/			\
/	d)	Given a current carrying wire located in a magnetic field, determine the force exerted on a length L of this wire.	\
/			\

Suggested Study Procedures

Review the definition of cross product on pages 23-24 in Chapter 1 very carefully and study Example 1-12. Study Sec. 27-1, 27-2, 27-4, 27-5, 27-6, 27-7.

Study carefully the relative directions of the three mutually perpendicular vectors in Fig. 27-6. Study Examples 27-1, 27-3, 27-5, and 27-7.

The Hall effect is an important and useful application of the material in this Objective, and it will be discussed in lecture. Look over Sec. 27-9 to see how this phenomenon can be applied to semiconductors.

Suggested Problems Related to Objective 12:

Chapter 27, Problems: 1, 2, 4, 6, 15, 22, 28, 37, 38, 42

HOMEWORK ASSIGNMENTS FOR STUDY GUIDE 3

Homework Assignment #9 - due at 5:00 pm Friday, April 10

This assignment is to be submitted via the web. In your web browser, go to www.masteringphysics.com. Then login using the username and password you have chosen.

After logging in, click on Assignment List and select Homework #9. If you need any review, you can always do that by repeating Assignment 0, a brief, noncredit tutorial on how to enter answers in Mastering Physics. In Homework #9, you will get 10 chances to submit a correct answer for each problem. If your first answer is incorrect, you should consider making use of the hints. There is no penalty for opening a hint, and no penalty for giving a wrong answer to a hint. However, if you request an answer to a hint, you will lose some points.

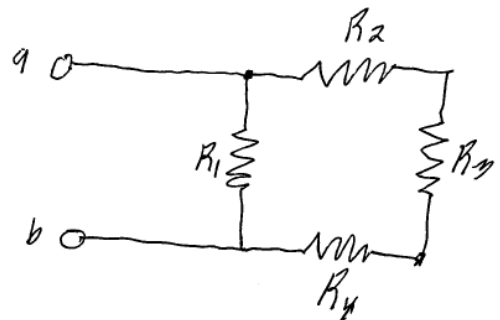
Homework Assignment #10 - due in lecture Monday, April 13

1. A battery has an emf of 15.0 V and an internal resistance of 0.120 Ω , and is connected across a resistor R_1 with resistance 3.50 Ω .

(a) Determine the voltage across the resistor R_1 .

(b) A resistor R_x is now added in parallel to R_1 , while still connected to the battery, and it is found that the voltage across the resistor R_1 is reduced to 12.80 V. Determine the resistance of R_x .

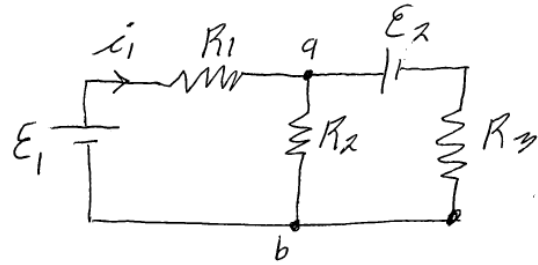
2. In the circuit shown, $R_1 = 14 \Omega$, $R_2 = 2 \Omega$, $R_3 = 3 \Omega$, and $R_4 = 4 \Omega$. (a) Find the equivalent resistance between points a and b, and (b) Calculate the current through and the voltage across each resistor if a potential difference of 55.0 V is applied between points a and b.



Homework Assignment #11 - due in lecture Wednesday, April 15

1. In the circuit shown, $\mathcal{E}_1 = 15 \text{ V}$, $R_1 = 3 \Omega$, $R_2 = 5 \Omega$, $R_3 = 2 \Omega$, and $i_1 = 2.5 \text{ A}$.

- a) Determine the potential difference between points a and b
b) Determine the emf \mathcal{E}_2



2. A 5.50 nF capacitor is initially charged to a potential of 90 V , and is then discharged through a $25 \text{ k}\Omega$ resistor starting at time $t=0$.
(a) Determine the initial current through the resistor (just after time $t=0$). (b) At what time does the voltage across the capacitor become 20 V ? (c) After a long time has elapsed ($t \rightarrow \infty$), how much energy has been dissipated as heat in the resistor?

Homework Assignment #12 - due at 5:00 pm Friday, April 17

This assignment is to be submitted via the web. In your web browser, go to www.masteringphysics.com. Then login using the username and password you have chosen.

After logging in, click on Assignment List and select Homework #12. If you need any review, you can always do that by repeating Assignment 0, a brief, noncredit tutorial on how to enter answers in Mastering Physics.

In Homework #12, you will get **10** chances to submit a correct answer for each problem. If your first answer is incorrect, you should consider making use of the hints. There is no penalty for opening a hint, and no penalty for giving a wrong answer to a hint. However, if you request an answer to a hint, you will lose some points.