Dr. Boudreaux Learning Goals for Physics 123

*Chapter 21*

Electric Charge:

Describe the evidence for different types of electric charge

Explain the interactions that occur between charged and uncharged objects

Describe the observational basis for classifying materials as conductors or insulators

Apply a qualitative model for electric charge to predict and explain the behavior of a foil leaf electroscope in various situations

Explain charging by induction

• Apply a qualitative model for electric charge to explain phenomenon such as charging by contact, discharging by contact, polarization, and charging by induction

• Apply Coulomb’s law and superposition to determine the net electric force exerted on a test charge by a given arrangement of point source charges

• Describe how to use a probe charge to measure the electric field at a given location

• Relate electric charge, electric force, and electric field in specific physical situations

• Use knowledge of the electric field created by a point charge, together with superposition, to determine the net electric field produced by a given arrangement of point source charges

• Use knowledge of the electric field created by a point charge, together with superposition and the principles of integral calculus to determine the net electric field produced by a continuous charge distribution

• Understand and apply a set of “rules” for the behavior of electric fields in and near conductors

• Find the direction of the net force and net torque exerted on a dipole placed in an external electric field

Types of problems:

1. Charging conducting roads

2. How to place charges given desired force/attributes

3. How to find unknowns in a given charge arrangement

4. How forces combine and act in a system with multiple charges

5. Determining electric fields given a charge distribution

6. Determine net electric field due to multiple point charges

7. Find the magnitude and direction of electric fields

8. Electric field properties inside a conductor

9. Electric fields produced by finite length rod

10. Finding a zero-field point

11. Drawing electric field vectors

Electric Field:

Describe the procedure for measuring the electric field

Determine the force exerted on a point charge in a given electric field

Apply the principle of superposition to determine the field produced by a collection of point charges

Chapter 22

Types of problems:

1. Gauss's Law in 3,2, and 1 Dimension

2. The Charge inside a conductor

3. The electric field and surface charge at a conductor

Chapter 23

• Describe the steps needed to use a probe charge to measure the electric potential difference between two locations

• Apply the definition of work to find the sign and amount of work done by the electric field when a probe charge moves from one location to another

• Relate electric potential difference, work done by the electric field does, and change in potential when a probe charge q is moved from one location to the other

• Describe how the concept of a reference location can be employed in order to assign a value for the electric potential at a given location

• Use the expression for the potential due to a point charge along with the concept of superposition to find the electric potential due to a collection of point charges

• Use the principle of superposition to find the potential energy associated with a collection of point charges

• Use the principle of superposition to find the electric potential due to a continuous distribution of charge

Find the work done by the electric field as a point charge moves between two locations

Relative work done by the field to the electric potential difference

Explain the use of a reference location in measuring electric potential

Apply superposition to determine the potential due to a collection of point charges

Use equipotential diagrams to relate electric potential and electric field

Types of problems:

1. Electric potential, potential energy, and force

2. Electric potential energy versus electric potential

3. Electric fields and equipotential surfaces

4. Energy stored in a charge configuration

5. Potential of a Charged Annulus

6. Potential of a Charged Cylinder

Chapter 25

Types of problems:

Electric Circuits:

Construct and identify complete circuits involving batteries, bulbs, switches and wires

Identify series and parallel connections in electric circuits

Represent electric circuits with circuit diagrams

Apply a qualitative model for electric circuits to predict the relative brightness of bulbs in a circuit

Identify short circuits

Extend the model for electric circuits to include the concept of potential difference

Use an ammeter and voltmeter to make quantitative measurements in a circuit

Apply ohm's law to relate voltage, current, and resistance for linear resistors

Apply the relationship between voltage and current for a bulb, and explain how this relationship differs from ohm's law

Combine qualitative and quantitative reasoning in the analysis of circuits, especially using Kirchoff's Laws

Types of problems:

1. Capacitance

2. Capacitance and Electric Field of a Spherical Capacitor

3. Capacitors in Parallel

4. Capacitors in Series

5. Kirchoff's rules and applications

6. Brightness of Light Bulbs / Ranking Current

7. Networks of Capacitors in both series and parallel

Types of problems:

1. Power delivered to resistors

2. Dependence of Resistance on Resistor dimensions

3. Networks of charged capacitors and resistors

4. RC Circuits

5. Capacitors as power supplies

6. Power

1. Kirchoff's Loop and Junction rules and applications

2. Resistors in series and parallel

3. Resistance and Resistivity

Magnetism:

Explain how objects can be classified according to their magnetic properties

Distinguish between magnetic and electrostatic interactions

Map the magnetic field vectors created by a bar magnet

Apply the principle of superposition to determine the field produced by multiple magnets

Types of problems:

1. Faraday's Law and Induced EMF

2. Induced Current in a Metal Loop

3. Motion induced electric fields and motional EMF

4. Magnetic Flux and induced EMF in coils

5. Sources of magnetism

6. Faraday's Law and Lenz's Law