Chapter 33
Electric Fields and Potential

Standards:
5.e. Students know _____ particles are sources of electric _____ and are subject to the _____ of the electric fields from other _____.
5.f. Students know _____ materials and electric _____ (_____ electric charges) are sources of _____ fields and are subject to _____ arising from _____ fields of other sources.
5.g. Students know how to determine the _____ of a magnetic field produced by a current flowing in a _____ wire or in a _____.
5.h. Students know c_____ magnetic fields produce _____ fields, thereby inducing _____ in nearby conductors.

Objectives:
1. Describe how the strength of an _____ field at two different _____ can be compared.
2. Describe how the _____ of an _____ field at a point is _____.
3. Relate the _____ of electric field _____ to the _____ of the field.
4. Describe the condition sunder which something can be completely _____ from an _____ field.
5. Explain why a _____ object in an _____ field is considered to have _____ potential.
6. Distinguish between _____ potential energy and electric _____.
7. Describe the _____ of a _____ generator.

Goals
This chapter develops the concept of the _____ field. The concept of _____ is built up from electric _____ and electric potential _____. The chapter concludes with a discussion of the _____ generator.

Introduction
The _____ around a strong _____, a _____ hole, or a concentration of _____ charge is not the same as the space would be if _____ of those things were there.

The _____ is _____ and is said to contain a _____ field.

33.1 Electric Fields

The _____ field that _____ a _____ is a _____ field. We think of objects _____ with gravitational fields rather than the _____ that are responsible for the_____.
The _____ around every electric _____ is filled with an electric _____. An _____ force holds an _____ in orbit around a _____.
There is _____ contact between the electron and the proton, they are “acting at a _____.”
The _____ interacts with the _____ field of the _____, and are _____ in _____ with this_____.
The force that one _____ charge _____ on _____ can be described as the _____ between one _____ and the electric _____ set up by the other. An electric field has both _____ and _____. Its _____ can be measured by its _____ on _____ located _____ the field. Where the _____ on a _____ is _____, the _____ is _____.

Where the _____ on a _____ is the _____, the _____ is _____.
The _____ of the electric field is the direction of the electrical _____ on a small _____ test charge.
If the charge that sets up the field is _____, then the force is _____ from that charge. If the charge that sets up the field is _____, then the force is _____ that charge.

33.2 Electric Field Lines

Since an electric _____ has both _____ and _____, a useful way to describe an electric field is with electric field _____, also called _____ of _____. Where the lines are farther _____, the field is _____. Where the lines are closer _____, the field is _____.
For an _____ charge, the _____ extend to _____. For two or more _____ charges, the lines _____ from a _____ charge and _____ on a _____ charge. Charges are spread out over a wide variety of surfaces, and they _____.
This _____ is communicated to neighboring _____ by changes in the electric _____.
The electric field is a _____ of _____.

Please leave room to write and answer the question on p. 521.

33.3 Electric Shielding

A _____ test charge located exactly in the _____ of a conductor would feel _____ force.

The _____ on one side of the conductor would tend to _____ the test charge to the _____. But, the electrons on the _____ side of the conductor would tend to pull a test charge to the _____ equally hard, _____ the _____ on the _____ of a _____ have spread themselves _____ over the _____ of the conductor.

The _____ force on the test charge would be _____, therefore the electric _____ is _____. In fact, complete _____ will occur _____ inside the conductor. This is why a certain electronic _____ are encased in _____ boxes, and why certain _____ have a heavy-metal _____ -- to _____ them all from _____ electrical activity.

Please leave room to write and answer the question on p. 523.

33.4 Electric Potential Energy

A _____ object can have _____ energy by virtue of its _____ in an _____ field. _____ is required to _____ a _____ particle _____ the electric _____ of a charged body. The electric potential energy of a charged particle is _____ when _____ is done to _____ it _____ the electric _____ of something _____ that is _____. If we push a small _____ charge _____ to a _____ charged sphere, we will expend _____ to overcome electrical _____. Just as _____ is done in _____ a _____, work is done in _____ the _____ _____ the electric _____ of the sphere. This _____ is equal to the energy _____ by the _____. The energy that charge now _____ by virtue of its _____ is called electric _____ energy. If the charge is _____, it will _____ in a direction _____ from the sphere, and its electric _____ energy will transform into _____ energy.

33.5 Electric Potential

If we push _____ charges instead, we do _____ as much work. _____ charges in the _____ location will have _____ the electric _____ energy as _____.

Rather than deal with the _____ potential energy of a _____ of charges, it is convenient to consider the electric potential energy _____ charge. This is the

_____ electric potential energy _____ by the _____ of the charge at any location. The potential energy per charge – whatever the _____ of charge – will be the same.
This is called _____ potential.

$$\text{Electric Potential} = \frac{\text{Electric } \_\_\_\_\_ \text{ Energy}}{\_\_\_\_\_}$$

The SI unit of measurement for electric _____ is the _____. The symbol for volt is _____. The _____ energy is measured in _____, _____, and _____ is measured in _____, C.

$$1 \_\_\_\_\_ = 1 \ \frac{\_\_\_\_\_}{\_\_\_\_\_}$$

A _____ of 1 _____ _____ 1 _____ of _____ per _____ of charge.

NOTE: 1 _____ is a _____ amount of charge.

Please leave room to write and answer the Question on p. 525.

If a _____ has a potential of _____ volts, it would take _____ _____ of energy per _____ to bring a _____ charge from _____ far away and _____ it to the charge on the _____. Since electric potential is measured in _____, it is commonly called _____.

33.6 Electric Energy Storage
Electrical energy can be _____ in a device called a _____. A capacitor is a_____ of conducting _____ separated by a _____ distance, but _____ touching each other. When the plates of a capacitor are attached to the _____ and _____ terminals of a _____ the following happens. The _____ side of the battery terminal pulls _____ from the plate connected to it, and the battery "_____" the electrons _____ the battery's _____ terminal to the _____ plate.

The _____ has _____ and _____ charge on both _____. The charging process is _____ when the potential _____ between the

plates _____ the potential difference between the battery _____ – the battery _____. The _____ the battery _____, and the _____ the plates and the _____ together they are, the _____ charge the capacitor can _____. A charged capacitor is _____ when a _____ path is _____ between the _____. The power supply of a TV set, even if it is turned _____, has capacitors which have _____ that can be _____ if discharged _____ a person! The _____ stored in a _____ comes from the _____ required to _____ it. The _____ is in the form of the electric _____ between its _____.

Between _____ plates the electric field is _____, so the _____ stored in a _____ is energy stored in the _____ field. Electric fields are storehouses of _____. Electric fields can be directed _____ and guided _____ metal wires, and _____ over _____ distances.

33.7 The Van de Graaff Generator

The Van de Graaff Generator is a lab device for building up high _____. The revolving _____ inside the machine carries _____ from where they are deposited, at the bottom of the belt, to the _____ of the belt, in the _____. The_____ of the dome has _____ charge, so the electrons _____ from the _____, through the _____ of the dome, to the _____ of the dome. A 1 meter dome can develop voltages as high as _____ million volts. At _____ million volts, air _____ down, and the machine can _____ through the _____.

Possible Misconceptions to Correct

1. Electric _____ energy and electric _____ are the _____ thing.
2. A _____ is a _____ of electrical _____.
3. _____ voltage is _____ under _____ circumstances.
4. The _____ produced by rubbing a balloon on one's hair is _____ compared to the _____ of electric _____ in the household.