Chapter 16 Electric Forces and Fields

1. On the basis of the behavior of ordinary materials be able to defend the claim that there are only two different types of electric charge.
2. Know the kind of charge acquired by a balloon when it is rubbed with a woolen cloth.
3. Be able to sketch and label a reasonable diagram of an atom.
4. Be able to state the SI units for electric charge, the SI units for the strength of an electric field, and the SI units for the strength of a gravitational field.
5. Be able to describe an electric field as something
   - that is produced by particles that have electric charge,
   - that fills the space surrounding these electrically charged particles,
   - that exerts forces on other electrically charged particles that are within it,
   - that has a strength and a direction, and therefore is described as a vector,
   - and that stores energy, which we commonly refer to as "electric potential energy."
6. Be able to sketch field line diagrams for electric fields produced by
   - an isolated charged particle (+ or −)
   - an electric dipole
   - two particles having the same type of electric charge
   - two parallel metal plates having equal and opposite charges
7. Be able to use electric field line diagrams to compare the strengths (stronger or weaker) and to determine the directions of the electric field at any given location in the diagram.
8. Be able to distinguish among the concepts of 1) "electric field," 2) the strength of an electric field at a certain location, and 3) the force exerted by an electric field on an object that possesses electric charge.
9. Be able to explain in terms of an atomic model of matter how ordinary items become "charged" by rubbing against other items.
10. Be able to use the metallic bond model for metals to explain: 1) how metals can be charged by conduction or by induction, 2) how metallic objects respond to the presence of other charged objects nearby, and 3) what grounding a metallic object does to a metallic object.
11. Be able to describe what is meant by "grounding" in the context of electricity as opposed to a consequence of misbehaving.
12. Be able to use a covalent bond model for materials to explain: 1) how insulators can be charged, 2) how covalently bonded insulators respond to the presence of other charged objects nearby, and 3) what touching an insulator to ground does to the insulator.
13. Be able to determine the kind of electric charge on an object by its interactions with positively charged objects, negatively charged objects, and neutral objects.

14. Be able to explain why having a "static" electrical charge means that a charged object is at equilibrium, electrically speaking.

15. Be able to explain why excess charge is concentrated at corners and edges of metals that carry a static electric charge.

16. Be able to explain why electric fields are necessarily normal to the surface of metals that carry a static charge.

17. Be able to draw charge diagrams to show the distribution of electric charge on an electroscope that is affected by other charged objects brought near its top.

18. Be able to explain how a neutral macroscopic object is attracted by a charged object due to polarization, but a neutron is not electrically attracted to protons or electrons.

19. Be able to determine the direction of force that a known electric field will exert on a positively charged particle and on a negatively charged particle.

20. Be able to determine the magnitude and direction of the force exerted by an electric field of known strength and direction on a charged particle of known charge.

21. Be able to use Coulomb's Law to calculate the strength and direction of the electric field produced by one or more charged particles at a point in their vicinity.

22. Be able to determine how the strength of an electric field $\mathbb{E}$ changes as the distance from a charged particle changes by a known factor.

23. Be able to describe how electric fields and gravitational fields are similar and how they differ.