Chapter 17: Electric Potential and Energy in Electric Fields

1. Be able to define electric potential in words and mathematically. Be comfortable thinking of electric potential as a "potential energy load factor."
2. Be able to distinguish between electric potential and electric potential energy conceptually as well as by their respective units.
3. Be able to state what it means that electric potential is a scalar, not a vector.
4. Be able to identify electric potential as a property of places in electric fields rather than a property of charged particles.
5. Be able to state the units in which we measure electric potential and to describe what these units mean.
6. Be able to describe the difference between potential and potential difference.
7. Be able to define voltage and distinguish it from potential.
8. Be able to use a voltmeter to measure the difference in potential between two positions.
9. Be able to calculate the amount of electric potential energy associated with a particle given its electric charge and the value of the electric potential where it is placed.
10. Be able to determine the strength and direction of an electric field from the graph of potential *vs* position arising from this field.
11. Be able to determine the magnitude and direction of the electric field at any location between oppositely charged parallel plates, given the potential of each plate and the distance between them.
12. Be able to represent the electric field between parallel metal plates with
    (a) electric field lines,
    (b) electric field vectors, or
    (c) equipotential lines.
13. Be able to state what happens to the potential energy associated with two oppositely charged particles when they are pulled apart or when they fall together.
14. Be able to state what happens to the potential energy associated with two particles with the same kind of charge when they are pushed together or when they fly apart from each other.
15. Be able to find the electric potential at any given distance from a particle possessing a known amount of electric charge.
16. Be able to calculate the electric potential energy possessed by a group of two or three electrically charged particles at known positions with respect to one another.
17. Be able to find the change in kinetic energy of electrons and protons in a vacuum when crossing a known difference in potential.

18. Be able to describe how one can find the amount of electric charge possessed by electrons by Millikan's experiment.

19. Given a simulation of Millikan's apparatus for finding the magnitude of charges on oil drops, be able to determine the size of the elementary charge and to justify that it is, indeed, the smallest electrical charge.

20. Be able to use an equipotential map to sketch the direction of and to find the strength of the electric field at various positions.

21. Be able to use the field line diagram for an electric field to compare the strength of the field at different locations.

22. Be able to describe the purpose of capacitors in electric circuits.

23. Be able to describe what capacitance is in words.

24. Be able to describe how the charge stored in a parallel-plate capacitor depends on the size of its "plates" and on the distance between its plates and the material between its plates.

25. Be able to explain how touch-sensitive devices exploit capacitance in their operation.

26. Be able to explain why dielectrics increase the capacitance of a capacitor.

27. Be able to calculate the energy stored in a capacitor.

28. Be able to calculate the total capacitance of two or more capacitors in series.

29. Be able to calculate the total capacitance of two or more capacitors in parallel.