Chapter 18

Terms

Be able to define or discuss the following terms and ideas, with their SI units if appropriate.

1. charge of a proton
2. charge of an electron
3. net charge (or total charge) of an atom or object
4. ion
5. conservation of charge
6. conductor
7. insulator
8. electron cloud
9. dipole
10. induced dipole
11. polar molecule (e.g. a water molecule)
12. polarization of an atom in an insulator
13. polarization of a metal object
14. charging by induction
15. surface charge
16. surface charge density
17. battery; positive terminal; negative terminal
18. electron current
19. conventional current
20. capacitor
21. charging capacitor
22. discharging capaitor
23. resistance

Equations

Understand the meaning and know the SI units of all symbols in these equations; know how to perform each mathematical operation, such as trig functions; know how to solve for any unknown quantity; understand how changing one quantity affects another quantity (if all other quantities remain constant); be able to apply one or more equations to solve a problem.

- The total charge Q on an object with n excess electrons or protons is $Q = ne$ where e is the magnitude of the charge of an electron or proton. $e = 1.6 \times 10^{-19}$ C

Skills

1. Describe why a charged object and a conductor will attract.
2. Describe why a charged object and an insulator will attract.
3. Sketch induced dipoles in an insulator when a charged object is brought near to the insulator.
4. Describe why a "free" dipole will twist in such a way that it will attract a charged object.
5. Sketch polarization of a conductor when a charged object is brought near to the conductor.
6. In a circuit diagram of a battery and bulb, sketch the direction of electron current and sketch the direction of conventional current.
7. In a circuit diagram of a battery, a bulb, and a capacitor (connected *in series*), predict which capacitor plate will become positively charged and which plate will become negatively charged.
8. In a circuit diagram of a battery, a bulb, and a capacitor (connected *in series*), predict how the brightness of the bulb will change as charge builds up on each capacitor plate until the capacitor is fully charged.
9. In a circuit diagram of a fully charged capacitor and a bulb, describe the direction of electron current as the capacitor discharges.
10. In a circuit diagram of a fully charged capacitor and a bulb, describe the brightness of the bulb as the capacitor discharges.
11. Describe how the resistance of the bulb affects *how long* it takes the capacitor to charge (or discharge), *how fast* electrons flow through the bulb and battery as the capacitor charges (or discharges), and *the maximum* charge that can build up on a charging capacitor.

Lab Skills

1. Build an electroscope.
2. Use an electroscope to determine whether the charge on an object is positive or negative.
3. Charge objects, such as aluminum cans, by induction.