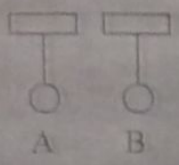


1. Two lightweight, conducting objects hang straight down on insulating strings when both are neutral. They are close enough together to interact, but not close enough to touch. Draw pictures showing how the objects hang if:
   a. Both are touched with a plastic rod that was rubbed with wool.

   b. Object A is touched by a plastic rod that was rubbed with wool, and object B is touched by a glass rod that was rubbed with silk.

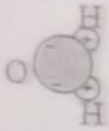
   c. Object A is charged by a plastic rod that was rubbed with fur. Ball B is neutral.

2. After combing your hair briskly, the comb will pick up small pieces of paper.
   a. Is the comb charged? Explain.

   b. How can you be sure that it isn't the paper that is charged? Propose an experiment to test this.

   c. Is your hair charged after being combed? What evidence do you have for your answer?

3. A negatively charged electroscope has separated leaves. Suppose you bring a negatively charged rod close to the top of the electroscope, but not touching. How will the leaves respond. Use words and charge diagrams to explain



4. The figure shows a molecule of water, which has more negative charge on the oxygen side, and more positive charge on the hydrogen side.
   a. Draw a picture showing how this molecule will move if a positive charge is held just above the molecule.

5. The figure shows an atom with four protons in the nucleus and four electrons in the electron cloud.
   a. Draw a picture showing how this atom will change and move if a positive charge is held just above the atom.

6. For each pair of charges, draw a force vector on each charge to show the electric force acting on that charge. The length of each vector should be proportional to the magnitude of the force. Each + and – symbol represents the same quantity of charge.

   a.

   b.

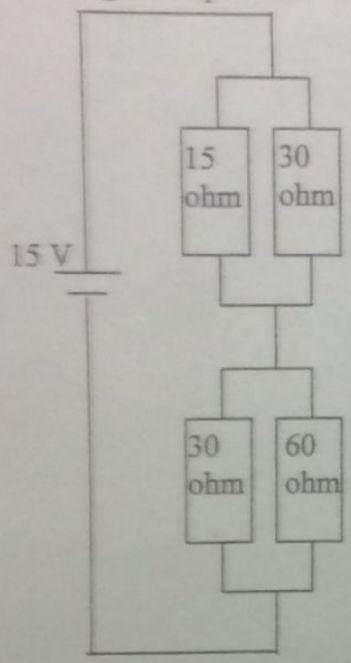
   c.

7. For the following group of charges, draw arrows to show the forces acting on the gray positive charge. Then use a dotted arrow to show the net force on the gray positive charge.
   Finally, show the pattern of the electric field generated by the two white charges.

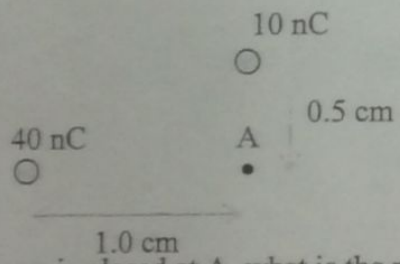
8. Discuss electrical aspects of the following quantities and configurations which could lead to a fatal electric shock:
   a. Voltage
   b. Current
   c. Time
   d. Wet conditions
   e. Placement of hand(s)

Numerical problems:

1. RIVP problem for the following circuit: Create the chart, and find the current, voltage, and power in each resistor, and in the total circuit.



2. Find the Electric field at the point A, including magnitude and direction:



If a 1.1 μC charge is placed at A, what is the magnitude of the force on it?

3. A turbine generator converts water power to 100,000 Volts of electricity. Assume 90% conversion efficiency. The turbine is situated in a dam that is 50 m high, and 220,000 kg of water flows over the dam every second.

a. What is the output electrical power of the dam?

b. What is the electric current produced by the generator when operating at 100,000 V?

c. If the power must be transmitted through wires with total resistance 10 ohms in order to reach the city, what is the power wasted in transmission?

4. A pair of parallel plates is 1 cm apart and has an electric field of 2.5 x 10^6 N/C between the plates.

a. If 0.2 couloumb of charge is transferred from the negative to the positive plate, what is the change in potential energy of the charge?

b. If the charge leaks back to original plate over a period of 75 seconds, what is the electric current that flows?

Find current through the 10V battery