

Electrostatics

Name _____

Concepts:

- 1) What are the three properties of charges that we know?

- 2) How many types of charges are there, what are their names and why?

- 3) Draw an atom and label its parts

- 4) Which part of the atom is most likely to move and why?

- 5) Name two people who did much of the early work with electrostatics?

- 6) What are the three methods of charging an object and how do they work?

- 7) What is grounding and how does it work?

- 8) In class I introduced a device used to study electrostatics, what is it called?

- 9) Draw and label the part of it.

- 10) For each type of charge and for each of the three ways of charging fully describe what will you expect to happen when using this device. Include descriptions of the direction of movements of the charges and any thing that you see change in the device.

- 11) Explain How does lightning is formed?
- 12) What are the six types of lightning?
- 13) What is an electric dipole?
- 14) Why are some materials good insulators and other materials good conductors?
- 15) What does dielectric strength refer to?
- 16) Why do charges tend to group at points?
- 17) How does a Van De Graf generator work?
- 18) What is an electric field?
- 19) Which way do electric fields go?
- 20) What is electric shielding?
- 21) Explain what the net charge is for a hollow conducting sphere if it is measured
 - a) inside the sphere.
 - b) in the material of the sphere itself.
 - c) outside the sphere.
- 22) What is electric potential (also known as electric field potential)? Explain.
- 23) What unit is used for it and what is the unit equal to?
- 23) What is electric potential energy and what is its unit?
- 24) What two devices store electric charge?

Exercises: (show all work)

25) Write Coulomb's Law and explain each part of it.

26) What are the units for charge and for the Coulomb force?

27) $q_1 = 2$, $q_2 = 2$, and $r = 2$ meters find F_e .

28) $q_1 = 2$, $q_2 = 7$, and $r = .5$ meters find F_e .

29) $q_1 = 6 \times 10^{-19}$, $q_2 = 4 \times 10^{-19}$, and $r = 1 \times 10^{-14}$ meters find F_e .

30) If $F = 20$ N and $q_1 = 5$, $q_2 = 10$ find r .

31) If $F = 300$ N and $q_1 = .4$, $q_2 = 17$ find r .

32) If $F = 20$ N and $r = .15$ meters and both objects have the same charge, find q .

problems: (show all work including equations, knowns, substitution and answer with units)

Note: going forward more information will be included in many of the problems than is actually needed. You will have to decide what is important and what is not important to solving the problem.

33) A 5 ft five inch tall girl stands with her hands on a Van De Graf Generator. As a result her hair stands on end. If the strands of her hair are 10 cm apart and the force between them is .04 N what is the charge on each strand?

34) One proposal for lifting a rocket up into space is to place a charge on it. This is called a rail gun. If the rocket was 40 meters tall and weighed 50,000 N how much charge would you need to put on it to lift it to 300 km?

35) The charge on both an electron and a proton are 1.6×10^{-19} C and the average distance across an atom is 1×10^{-14} m. If an atom has of lithium has 3 protons and 3 electrons what is the force between them?

- 36) If you rub your feet on a red carpet you can build up a charge. You then decide to shock a friend of yours. If the spark jumps 5 cm what is the voltage you have built up on your body? The dielectric strength of air is 3,000,000 volts/meter.
- 37) If a Van de Graf generator produces a spark in air of 10 cm what must the voltage on its surface be?
- 38) On this piece of paper and if needed additional pieces of papers draw the electric field lines for the following cases: Show a minimum of 8 field lines in each case.
- a) a positive charge
 - b) a negative charge
 - c) two positive charges
 - d) two negative charges
 - e) one positive and one negative charge
 - f) one positive charge of 2 C and one positive charge of 4 C
 - g) one negative charge of 2 C and a positive charge of 4 C
 - h) two parallel plates with positive charges on one side and negative on the other (a capacitor)