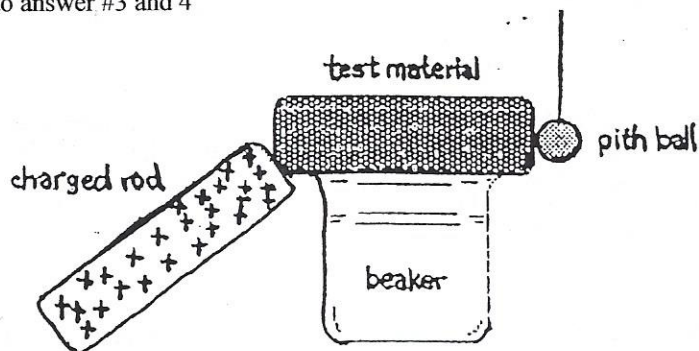


## Review – Electrostatics

1. A proton carries a positive charge and an electron carries a negative charge.
2. A glass rod is rubbed with a piece of silk. During the process the glass rod acquires a positive charge and the silk
  - a) acquires a positive charge also
  - b) acquires a negative charge
  - c) remains neutral
  - d) could either be positively or negatively charged depending on how hard the rod was rubbed

Use the diagram below to answer #3 and 4



3. In the diagram, if the test material is made of a conductor, what charge will be transferred to the pith ball?
  - a) neutral charge
  - b) positive charge
  - c) negative charge
  - d) no charge will transfer
4. If the test material in the diagram above is an insulator, what charge will be transferred?
  - a) neutral charge
  - b) positive charge
  - c) negative charge
  - d) no charge will transfer
5. Suppose an electroscope has a neutral charge. A negatively charged rod is brought near, but does not touch the electroscope. What explains what happens?
  - a) the leaves become negative and separate
  - b) the leaves become positive and separate
  - c) the leaves stay neutral and separate
  - d) the leaves stay together
7. An object charged by contact with a charged rod will
  - a) have the opposite charge as the rod
  - b) have the same charge as the rod
  - c) have a noncontact charge
  - d) be neutral
8. An object charged by induction from a charged rod will
  - a) have the opposite charge as the rod
  - b) have the same charge as the rod
  - c) have a noncontact charge
  - d) be neutral
9. What is the difference between a good conductor and a good insulator?
  - a) electrons are able to move easily in a good conductor
  - b) electrons are able to move easily in a good insulator
  - c) electrons are tightly held by a good conductor
  - d) protons are able to move easily in a good insulator
10. Which of the following statements explains what happens as you rub your feet across a rug?
  - a) you are grounded so no charge will build up on you
  - b) the rug does not have enough electrons to build up charge
  - c) you are given a negative charge while the rug is now positive
  - d) protons are rubbed from the rug to you



11. Two charges are separated by a distance of  $d$ . What will happen to the force between the two charges if the distance is increased to  $4d$ ?

- a)  $\frac{1}{4}$  as much
- b)  $\frac{1}{16}$  as much
- c)  $4x$  as much
- d)  $2x$  as much

$$F = k \frac{Q_1 Q_2}{r^2}$$

12. Gold, when rubbed with fur, acquires an excess of electrons. Brass also acquires electrons when rubbed with fur, though brass acquires fewer than gold. What will happen if brass and gold are rubbed together?

Gold becomes negative and brass becomes positive

13. Four different colored pith balls are attached by different strings to a ring on a ring stand. The yellow ball is charged by induction using a negative rod. The blue ball repels the green ball. The red ball and the blue ball are attracted to the yellow ball. What are the charges of each ball?

Y(+), R(-), B(-), G(-)

14. Sometimes during thunderstorms you feel a "tingling" and the hairs on your body stand on end. Why does this happen?

charged cloud either attracts or repels electrons charging the person by induction. Since all of person's hair has the same charge they repel each other.

15. A piece of plastic has a net charge of  $+2.00 \mu\text{C}$ . a) Does it have an excess or deficit of electrons? b) How many electrons are in excess or deficit?

a) deficit

$$b) Q = ne$$

$$(2.00 \times 10^{-6}) = n (1.602 \times 10^{-19})$$

$$n = 1.25 \times 10^{13} \text{ electrons}$$

16. Two point charges are initially  $2.0\text{cm}$  apart and experience a  $1.0\text{N}$  force. If they are moved to a new separation of  $8.0\text{cm}$ , what is the force they experience now?

$$F = k \frac{Q_1 Q_2}{r^2}$$

moved  $4.0x$  farther so force is  $\frac{1}{16}$  as much

$$(1.0) \left(\frac{1}{16}\right) = \boxed{0.0625\text{N}}$$

17. Sphere A carries a net charge and sphere B is neutral. They are placed near each other on an insulated table. Which statement best describes the force between them?

- a) There is no force between them since one is neutral
- b) There is a force of repulsion between them
- c) There is a force of attraction between them
- d) The force is attractive if A is positive and repulsive if A is negative

18. Two charged objects attract each other with a certain force. If the charges on both objects are doubled with no change in separation, the force between them

- a) quadruples
- b) doubles
- c) halves
- d) increase, but we can't tell how much without knowing the distance between them

19. Sphere A carries a net positive charge, and sphere B is neutral. They are placed near each other on an insulated table. Sphere B is briefly touched with a wire that is grounded. Which statement is correct?
- a) Sphere B remains neutral  
 b) Sphere B is now positive  
 c) Sphere B is now negative  
 d) Cannot determine



20. An originally neutral electroscope is grounded while a positively charged rod is held near it. After the rod is removed, the electroscope
- a) remains neutral  
 b) is negatively charged  
 c) is positively charged  
 d) could be either negative or positive

21. An atomic nucleus has a charge of +40 electrons. An electron is  $10^{-9}$  m from the nucleus. What is the force on the electron?

$$F = \frac{(9.0 \times 10^9)(40 \times 1.602 \times 10^{-19})(-1.602 \times 10^{-19})}{(10^{-9})^2} = -9.2 \times 10^{-9} \text{ N} \text{ attractive}$$

22. A  $+30 \mu\text{C}$  charge is attracted to a  $-90 \mu\text{C}$  charge with a force of 1.8 N. How far apart are the charges?

$$1.8 = \frac{(9 \times 10^9)(30 \times 10^{-6})(90 \times 10^{-6})}{r^2} \quad r = 3.7 \text{ m}$$

23. What is the charge on 1.00 kg of protons?

$$1.00 \text{ kg} \times \frac{1 \text{ proton}}{1.67 \times 10^{-27} \text{ kg}} = 5.99 \times 10^{26} \text{ protons}$$

$$Q = ne$$

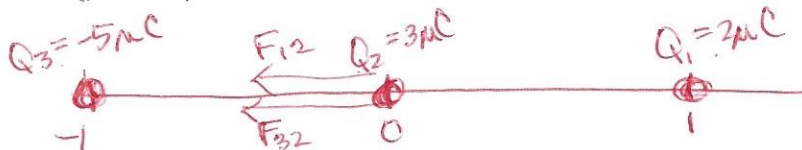
$$Q = (5.99 \times 10^{26})(1.602 \times 10^{-19})$$

$$Q = 9.6 \times 10^7 \text{ C}$$

24. A 1.0 C charge is 15 m from a second charge, and the force between them is 1.0 N. What is the magnitude of the second charge?

$$1.0 = \frac{(9 \times 10^9)(1.0)Q_2}{15^2} \quad Q_2 = 2.5 \times 10^{-8} \text{ C}$$

25. Three point charges are located at the following positions:  $Q_1 = +2.0 \mu\text{C}$  at  $x = 1.00$  m,  $Q_2 = 3.00 \mu\text{C}$  at  $x = 0$ , and  $Q_3 = -5.00 \mu\text{C}$  at  $x = -1.00$  m. What is the magnitude and direction of the force acting on the  $Q_2$ ?



$$F_{12} = \frac{(9 \times 10^9)(2 \times 10^{-6})(3 \times 10^{-6})}{1.0^2} = 0.054 \text{ N (left)}$$

$$F_{32} = \frac{(9 \times 10^9)(5 \times 10^{-6})(3 \times 10^{-6})}{1.0^2} = 0.135 \text{ N (left)}$$

$$F = 0.189 \text{ N (left)}$$