

Practice - Electrostatics (Conservation of Charge and Coulomb's Law)

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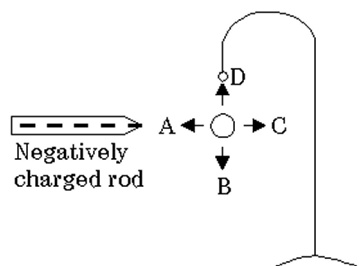
1. The unit of electrical charge in the MKS system is the

- A. volt
- B. ampere
- C. coulomb
- D. mho

2. A negatively charged rod is brought in contact with an electroscope. As the rod gives up electrons, the number of protons in the rod will

- A. decrease
- B. increase
- C. remain the same

3. In the diagram here a negatively charged rod approaches a neutral pith ball. In which direction will the pith ball move?



- A. A
- B. B
- C. C
- D. D

4. A particle of aluminum is found to have 13 protons in its nucleus with 10 electrons in orbit around the nucleus. This particle would be

- A. negatively charged
- B. positively charged
- C. electrically neutral
- D. heavier than a normal aluminum atom

5. What is the charge of an object repelled by a negatively charged rubber rod?

- A. It must be positively charged.
- B. It must be negatively charged.
- C. It may be neutral.
- D. It may be either positively charged or neutral.

6. Which procedure will give an electroscope a positive charge?

- A. touching the electroscope with a neutral object
- B. bringing a positively charged object near the electroscope
- C. touching the electroscope with a negatively charged object
- D. touching the electroscope with a positively charged object

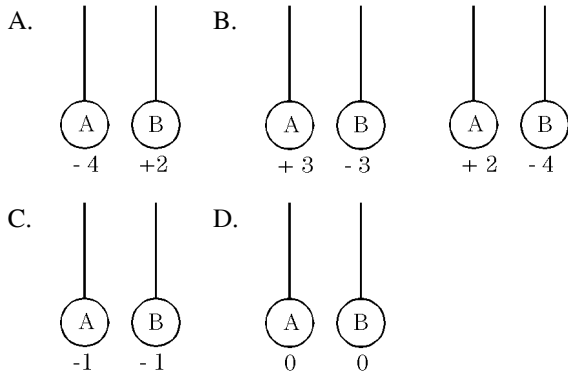
7. A charged electroscope can detect

- A. positive charge, only
- B. negative charge, only
- C. either positive or negative charge
- D. neither positive nor negative charge

8. A metal sphere with an excess of 11 electrons touches an identical metal sphere with an excess of 15 electrons. After the spheres touch, the number of excess electrons on the second sphere is

- A. 26
- B. 2
- C. 13
- D. 4

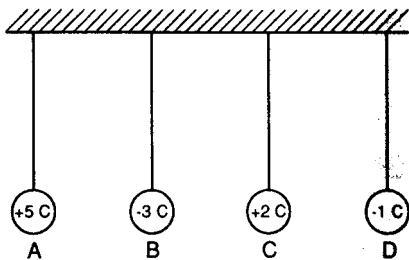
9. Objects *A* and *B* are charged as shown in the diagram. *A* and *B* are brought together and touched. Which is the correct distributions of charge after the two objects have been separated?



10. Two identical spheres carry charges of $+0.6$ coulomb and -0.2 coulomb, respectively. If these spheres touch, the resulting charge on the first sphere will be

- A. $+0.8$ C B. $+0.2$ C
C. -0.3 C D. $+0.4$ C

11. The diagram pictured shows four charged metal spheres suspended by strings. The charge of each sphere is indicated. If spheres *A*, *B*, *C*, and *D* simultaneously come into contact, the net charge on the four spheres will be



- A. $+1$ C B. $+2$ C C. $+3$ C D. $+4$ C

12. Sphere *A* has a charge of $+2 \times 10^{-6}$ coulomb and is brought into contact with a similar sphere, *B*, which has a charge of -4×10^{-6} coulomb. After it is separated from sphere *B*, sphere *A* will have a charge of

- A. -1×10^{-6} C B. -2×10^{-6} C
C. $+2 \times 10^{-6}$ C D. $+6 \times 10^{-6}$ C

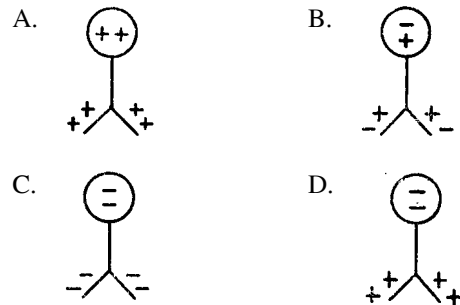
13. Two objects, *A* and *B*, are rubbed together. If object *A* acquires an excess of 100 electrons, object *B* must have

- A. gained 100 electrons
B. gained 100 protons
C. lost 100 electrons
D. lost 100 protons

14. A sphere has a net excess charge of -4.8×10^{-19} coulomb. The sphere must have an excess of

- A. 1 electron B. 1 proton
C. 3 electrons D. 3 protons

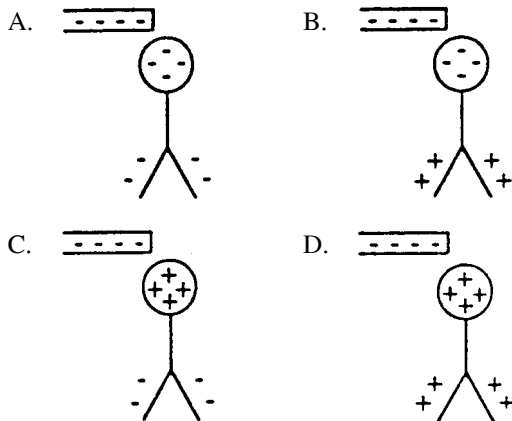
15. Which of the diagrams given shows the correct distribution of charge on the knob and leaves of an electroscope after it has made contact with a negatively charged hard rubber rod?



16. If an uncharged electroscope is touched with a neutral object, the separation of the leaves of the electroscope will

- A. decrease B. increase
C. remain the same

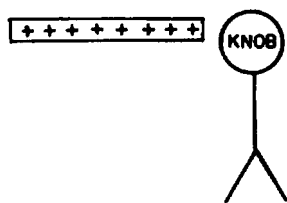
17. Which diagram best represents the charge distribution on a neutral electroscope when a negatively charged rod is held near it?



18. A negatively charged object is brought near the knob of a negatively charged electroscope. The leaves of the electroscope will

- A. move closer together
- B. move farther apart
- C. become positively charged
- D. become neutral

19. As shown in the diagram, a charged rod is held near, but not touching, a neutral electroscope. The charge on the knob is



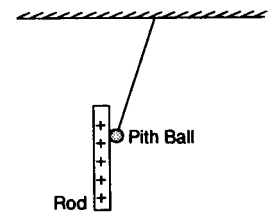
- A. positive and the leaves are positive
- B. positive and the leaves are negative
- C. negative and the leaves are positive
- D. negative and the leaves are negative

20. When a rod is brought near a neutral electroscope, the leaves diverge. Which statement best describes the charge on the rod?

- A. It must be positive.
- B. It must be negative.
- C. It may be neutral.
- D. It may be positive or negative.

21. As shown in the diagram, a neutral pith ball suspended on a string is attracted to a positively charged rod. During contact with the rod, the pith ball

- A. loses electrons
- B. gains electrons
- C. loses protons
- D. gains protons



22. A glass rod is given a positive charge by rubbing it with silk. The rod has become positive by

- A. gaining electrons
- B. gaining protons
- C. losing electrons
- D. losing protons

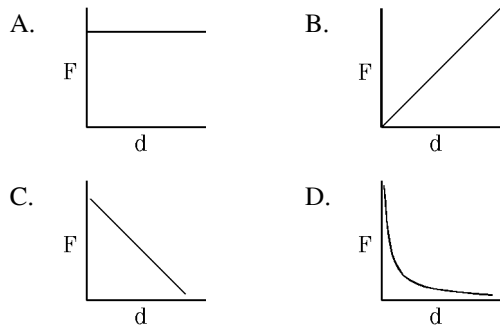
23. What is the magnitude of the electrostatic force and between a charge of $+3.0 \times 10^{-5}$ coulomb and a charge of $+6.0 \times 10^{-6}$ coulomb separated by 0.30 meter?

- A. 1.8×10^{-3} N
- B. 5.4×10^{-2} N
- C. 5.4×10^0 N
- D. 1.8×10^1 N

24. As the distance between two point charges is tripled, the electrostatic force between the charges

- A. decreases to one-ninth the original force
- B. decreases to one-third the original force
- C. increases by a factor of three
- D. increases by a factor of nine

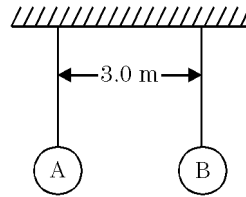
25. Electrostatic force F exists between two point charges with a separation distance d . Which graph best represents the relationship between F and d ?



26. Which procedure will double the force between two point charges?
- A. doubling the distance between the charges
 B. doubling the magnitude of one charge
 C. halving the distance between the charges
 D. halving the magnitude of one charge
27. What is the approximate electrostatic force between two protons separated by a distance of 1.0×10^{-6} meter?
- A. 2.3×10^{-16} N and repulsive
 B. 2.3×10^{-16} N and attractive
 C. 9.0×10^{21} N and repulsive
 D. 9.0×10^{21} N and attractive
28. If the charge on each of two small spheres a fixed distance apart is doubled, the force of attraction between the spheres will be
- A. quartered B. doubled
 C. halved D. quadrupled

29. The diagram given shows two metal spheres suspended by strings and separated by a distance of 3.0 meters. The charge on sphere A is $+5.0 \times 10^{-4}$ coulomb and the charge on sphere B is $+3.0 \times 10^{-5}$ coulomb.

Which statement best describes the electrical force between the spheres?



- A. It has a magnitude of 15 N and is repulsive.
 B. It has a magnitude of 45 N and is repulsive.
 C. It has a magnitude of 15 N and is attractive.
 D. It has a magnitude of 45 N and is attractive.
30. The magnitude of the electrostatic force between two point charges is F . If the distance between the charges is doubled, the electrostatic force between the charges will become
- A. $\frac{F}{4}$ B. $2F$ C. $\frac{F}{2}$ D. $4F$
31. Two protons are located one meter apart. Compared to the gravitational force of attraction between the two protons, the electrostatic force between the protons is
- A. stronger and repulsive
 B. weaker and repulsive
 C. stronger and attractive
 D. weaker and attractive

32. The charge-to-mass ratio an electron is approximately 1.75×10^{11} coulombs per kilogram. This value indicates that the
- electron's charge is about equal to its mass
 - charge on an electron is extremely small compared to its mass
 - mass of an electron is the same as that of an atom
 - mass of an electron is extremely small compared to its charge

33. A balloon is rubbed against a student's hair and then touched to a wall. The balloon "sticks" to the wall due to
- electrostatic forces between the particles of the balloon
 - magnetic forces between the particles of the wall
 - electrostatic forces between the particles of the balloon and the particles of the wall
 - magnetic forces between the particles of the balloon and the particles of the wall

34. As the number of free charges per unit volume of solid increases, its electrical conductivity
- decreases
 - increases
 - remains the same

35. Base your answer(s) to the following question(s) on the information and diagram below.

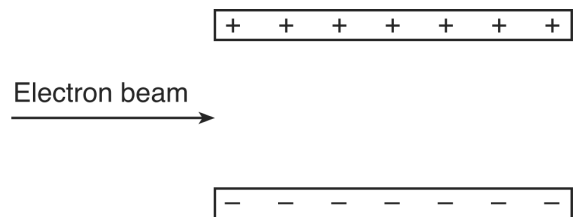
The centers of two small charged particles are separated by a distance of 1.2×10^{-4} meter. The charges on the particles are $+8.0 \times 10^{-19}$ coulomb and $+4.8 \times 10^{-19}$ coulomb, respectively.

Calculate the magnitude of the electrostatic force between these two particles. [Show all work, including the equation and substitution with units.]

36. On the axes below, sketch a graph showing the relationship between the magnitude of the electrostatic force between the two charged particles and the distance between the centers of the particles.



37. A beam of electrons is directed into the electric field between two oppositely charged parallel plates, as shown in the diagram below.



The electrostatic force exerted on the electrons by the electric field is directed

- into the page
 - out of the page
 - toward the bottom of the page
 - toward the top of the page
38. Two metal spheres, *A* and *B*, possess charges of 1.0 microcoulomb and 2.0 microcoulombs, respectively. In the diagram below, arrow *F* represents the electrostatic force exerted on sphere *B* by sphere *A*.



Which arrow represents the magnitude and direction of the electrostatic force exerted on sphere *A* by sphere *B*?

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-
-
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- 1. Answer: C
- 2. Answer: C
- 3. Answer: A
- 4. Answer: B
- 5. Answer: B
- 6. Answer: D
- 7. Answer: C
- 8. Answer: C
- 9. Answer: C
- 10. Answer: B
- 11. Answer: C
- 12. Answer: A
- 13. Answer: C
- 14. Answer: C
- 15. Answer: C
- 16. Answer: C
- 17. Answer: C
- 18. Answer: B
- 19. Answer: C
- 20. Answer: D

- 21. Answer: A
- 22. Answer: C
- 23. Answer: D
- 24. Answer: A
- 25. Answer: D
- 26. Answer: B
- 27. Answer: A
- 28. Answer: D
- 29. Answer: A
- 30. Answer: A
- 31. Answer: A
- 32. Answer: D
- 33. Answer: C
- 34. Answer: B
- 35. Answer: $2.4 \times 10^{-19} \text{ N}$
- 36. Answer:
- 37. Answer: D
- 38. Answer: A

