Electric Charge
due wed 1/22

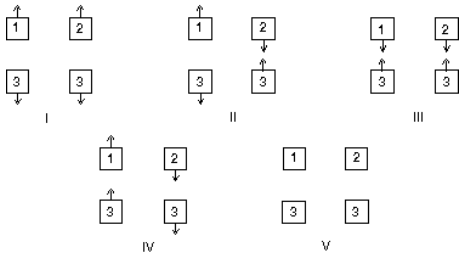
Name: _____

1. The charge on a glass rod which has been rubbed with silk is called positive:
   A) by arbitrary convention
   B) so that the proton charge will be positive
   C) to conform to the conventions adopted for *G* and *m* in Newton's law of gravitation
   D) because like charges repel
   E) because glass is an insulator

2. When a hard rubber rod is given a negative charge by rubbing it with wool:
   A) positive charges are transferred from rod to wool
   B) negative charges are transferred from rod to wool
   C) positive charges are transferred from wool to rod
   D) negative charges are transferred from wool to rod
   E) negative charges are created and stored on the rod

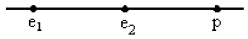
3. The diagram shows a pair of heavily charged plastic cubes that attract each other.

Cube 3 is a conductor and is uncharged. Which of the following illustrates the forces between cubes1 and 3 and between cubes 2 and 3?



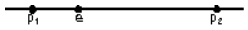
A) I
B) II
C) III
D) IV
E) V

4. Two electrons (e_1 and e_2) and an protin (p) lie on a straight line, as shown. The directions of the force of e_2 on e_1, the force of p on e_1, and the total force on e_1, respectively, are:



A) →, ←, →
B) ←, →, →
C) →, ←, ←
D) ←, →, ←
E) ←, ←, ←

5. Two protons (p_1 and p_2) and an electron (e) lie on a straight line, as shown. The directions of the force of p_1 on e, the force of p_2 on e, and the total force on e, respectively, are:



A) →, ←, →
B) ←, →, →
C) →, ←, ←
D) ←, →, ←
E) ←, ←, ←

6. To make an uncharged object have a negative charge we must:
   A) add some atoms
   B) remove some atoms
   C) add some electrons
   D) remove some electrons
   E) write down a negative sign

7. To make an uncharged object have a positive charge:
   A) remove some neutrons
   B) add some neutrons
   C) add some electrons
   D) remove some electrons
   E) heat it to cause a change of phase

8. An electrical insulator is a material:
   A) containing no electrons
   B) through which electrons do not flow easily
   C) which has more electrons than protons on its surface
   D) cannot be a pure chemical element
   E) must be a crystal

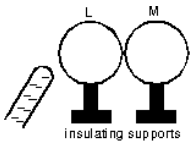
9. A conductor is distinguished from an insulator with the same number of atoms by the number of:
   A) nearly free atoms
   B) electrons
   C) nearly free electrons
   D) protons
   E) molecules

10. A neutral metal ball is suspended by a string. A positively charged insulating rod is placed near the ball, which is observed to be attracted to the rod. This is because:
    A) the ball becomes positively charged by induction
    B) the ball becomes negatively charged by induction
    C) the number of electrons in the ball is more than the number in the rod
    D) the string is not a perfect insulator
    E) there is a rearrangement of the electrons in the ball

11. A positively charged insulating rod is brought close to an object that is suspended by a string. If the object is attracted toward the rod we can conclude:
    A) the object is positively charged
    B) the object is negatively charged
    C) the object is an insulator
    D) the object is a conductor
    E) none of the above

12. A positively charged insulating rod is brought close to an object that is suspended by a string. If the object is repelled away from the rod we can conclude:
    A) the object is positively charged
    B) the object is negatively charged
    C) the object is an insulator
    D) the object is a conductor
    E) none of the above

13. Two uncharged metal spheres, L and M, are in contact. A negatively charged rod is brought close to L, but not touching it, as shown. The two spheres are slightly separated and the rod is then withdrawn. As a result:



A) both spheres are neutral
B) both spheres are positive
C) both spheres are negative
D) L is negative and M is positive
E) L is positive and M is negative

14. A positively charged metal sphere A is brought into contact with an uncharged metal sphere B. As a result:
    A) both spheres are positively charged
    B) A is positively charged and B is neutral
    C) A is positively charged and B is negatively charged
    D) A is neutral and B is positively charged
    E) A is neutral and B is negatively charged

15. The leaves of a positively charged electroscope diverge more when an object is brought near the knob of the electroscope. The object must be:
    A) a conductor
    B) an insulator
    C) positively charged
    D) negatively charged
    E) uncharged

16. A negatively charged rubber rod is brought near the knob of a positively charged electroscope. The result is that:
    A) electroscope leaves will move farther apart
    B) the rod will lose its charge
    C) electroscope leaves will tend to collapse
    D) electroscope will become discharged
    E) nothing noticeable will happen

17. An electroscope is charged by induction using a glass rod that has been made positive by rubbing it with silk. The electroscope leaves:
    A) gain electrons
    B) gain protons
    C) lose electrons
    D) lose protons
    E) gain an equal number of protons and electrons

18. Consider the following procedural steps:
    (1) ground the electroscope
    (2) remove the ground from the electroscope
    (3) touch a charged rod to the electroscope
    (4) bring a charged rod near, but not touching, the electroscope
    (5) remove the charged rod

    To charge an electroscope by induction, use the sequence:
    A) 1, 4, 5, 2
    B) 4, 1, 2, 5
    C) 3, 1, 2, 5
    D) 4, 1, 5, 2
    E) 3, 5

19. A charged insulator can be discharged by passing it just above a flame. This is because the flame:
    A) warms it
    B) dries it
    C) contains carbon dioxide
    D) contains ions
    E) contains more rapidly moving atoms

20. A coulomb is the same as:
    A) an ampere/second
    B) half an ampere · second^2
    C) an ampere/meter^2
    D) an ampere ·second
    E) a newton ·meter^2

21. A kiloampere · hour is a unit of:
    A) current
    B) charge per time
    C) power
    D) charge
    E) energy

22. The magnitude of the charge on an electron is approximately:
A) 10^{23} C
B) 10^{-23} C
C) 10^{19} C
D) 10^{-19} C
E) 10^{9} C

23. A wire contains a steady current of 2 A. The charge that passes a cross section in 2 s is:
A) 3.2×10^{-19} C
B) 6.4×10^{-19} C
C) 1 C
D) 2 C
E) 4 C

24. A wire contains a steady current of 2 A. The number of electrons that pass a cross section in 2 s is:
A) 2
B) 4
C) 6.3×10^{18}
D) 1.3×10^{19}
E) 2.5×10^{19}

25. A small object has charge Q. Charge q is removed from it and placed on a second small object. The two objects are placed 1 m apart. For the force that each object exerts on the other to be a maximum. q should be:
A) $2Q$
B) Q
C) $Q/2$
D) $Q/4$
E) 0

26. Two small charged objects repel each other with a force F when separated by a distance d. If the charge on each object is reduced to one-fourth of its original value and the distance between them is reduced to $d/2$ the force becomes:
A) $F/16$
B) $F/8$
C) $F/4$
D) $F/2$
E) F

27. Two identical conducting spheres A and B carry equal charge. They are separated by a distance much larger than their diameters. A third identical conducting sphere C is uncharged. Sphere C is first touched to A, then to B, and finally removed. As a result, the electrostatic force between A and B, which was originally F, becomes:
A) $F/2$
B) $F/4$
C) $3F/8$
D) $F/16$
E) 0

28. Two particles, X and Y, are 4 m apart. X has a charge of $2Q$ and Y has a charge of Q. The force on X to that on Y is:
A) has twice the magnitude of the force of X on Y
B) has half the magnitude of the force of Y on X
C) has four time the magnitude of the force of Y on X
D) has one-fourth the magnitude of the force of Y on X
E) has the same magnitude as the force of Y on X

29. The units of $1/4\pi\varepsilon_0$ are:
A) N^2/C^2
B) $N \cdot m/C$
C) $N^2 \cdot m^2/C^2$
D) $N \cdot m^2/C^2$
E) m^2/C^2

30. A 5.0-C charge is 10 m from a –2.0-C charge. The electrostatic force is on the positive charge is:
A) 9.0×10^8 N toward the negative charge
B) 9.0×10^8 N away from the negative charge
C) 9.0×10^9 N toward the negative charge
D) 9.0×10^9 N away from the negative charge
E) none of these

31. Two identical charges, 2.0 m apart, exert forces of magnitude 4.0 N on each other. The value of either charge is:
A) 1.8×10^{-9} C
B) 2.1×10^{-5} C
C) 4.2×10^{-5} C
D) 1.9×10^5 C
E) 3.8×10^5 C

32. Two particles have charges Q and $-Q$ (equal magnitude and opposite sign). For a net force of zero to be exerted on a third charge it must be placed:
A) midway between Q and $-Q$
B) on the perpendicular bisector of the line joining Q and $-Q$, but not on that line itself
C) on the line joining Q and $-Q$, to the side of Q opposite $-Q$
D) on the line joining Q and $-Q$, to the side of $-Q$ opposite Q
E) at none of these places (there is no place)

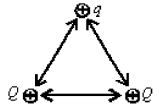
33. Particles 1, with charge q_1 and 2, with a charge q_2 are on the x axis, with particle 1 at $x = a$ with and particle 2 at $x = -2a$. For the net force on a third charged particle, at the origin to be zero q_1 and q_2 must be related by q_2=:
A) $2q_1$
B) $4q_1$
C) $-2q_1$
D) $-4q_1$
E) $-q_1/4$

34. Two particles A and B have identical charge Q. For a net force of zero to be exerted on a third chargeparticle it must be placed:
A) midway between A and B
B) on the perpendicular bisector of the line joining A and B but away from the line
C) on the line joining A and B, not between the particles
D) on the line joining A and B, closer to one of them than the other
E) at none of these places (there is no place)

35. A particle with charge 2μC charge is placed at the origin, an identical particle, with the same charge, is placed 2 m from the origin on the x axis, and a third identical particle, with the same charge, is placed 2 m from the origin on the y axis. The magnitude of the force on the particle at the origin is:
A) 9.0×10^{-3} N
B) 6.4×10^{-3} N
C) 1.3×10^{-2} N
D) 1.8×10^{-2} N
E) 3.6×10^{-2} N

36. A charge Q is spread uniformly along the circumference of a circle of radius R. A point particlewith charge q is placed at the center of this circle. The total force exerted on the particle q can be calculated by Coulomb's law:
A) just use R for the distance
B) just use $2R$ for the distance
C) just use $2\pi R$ for the distance
D) result of the calculation is zero
E) none of the above

37. Two particles, each with charge Q, and a third particle, with a charge q, are placed at the vertices of an equilateral triangle as shown. The total force on the particle with charge q is:



A) Parrallel to the left side of the triangle
B) Parrallel to the right side of the triangle
C) Parrallel to the bottom side of the triangle
D) perpendicular to the bottom side of the triangle
E) perpendicular to the left side of the triangle

38. A particle with a charge of 5×10^{-6} C and a mass of 20 g moves uniformly with a speed of 7 m/s in a circular orbit around a stationary particle with a charge of -5×10^{-6} C. The radius of the orbit is:
A) 0
B) 0.23 m
C) 0.62 m
D) 1.6 m
E) 4.4 m