**TEST 1-1 English version**
ELECTRIC CHARGE

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

2. The magnitude of the total negative charge on the electrons in 1 kg of helium (atomic number 2, atomic mass 4) is:
   A) 48 C   B) 2.4×10^7 C   C) 4.8×10^7 C   D) 9.6×10^8 C   E) 1.9×10^8 C

3. 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}

4. 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

5. 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

6. 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

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

8. 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

9. A charge Q is spread uniformly along the circumference of a circle of radius R. A point particle with 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   D) result of the calculation is zero
   B) just use $2R$ for the distance   E) none of the above
   C) just use $2\pi R$ for the distance

10. 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:
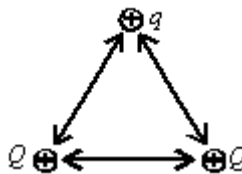
   A) parallel to the left side of the triangle
   B) parallel to the right side of the triangle
   C) parallel to the bottom side of the triangle
   D) perpendicular to the bottom side of the triangle
   E) perpendicular to the left side of the triangle

11. In the Rutherford model of the hydrogen atom, a proton (mass M, charge Q) is the nucleus and an electron (mass m, charge q) moves around the proton in a circle of radius r. Let k denote the Coulomb force constant ($1/4\pi\varepsilon_0$) and G the universal gravitational constant. The ratio of the electrostatic force to the gravitational force between electron and proton is:
   A) $kQq/GMmr^2$ D) GMm/kQq
   B) GQq/kMm E) kQq/GMm
   C) kMm/GQq