Electrostatics 2 : Notes/W.S.-20

The symbol for the elementary charge is "e". It is the charge on an electron or proton. This is the smallest unit of charge. Electric charge is defined in terms of the charge on the electron (-e) or proton (+e). These charges are equal but opposite.

The unit e is very small. It is convenient to introduce a larger unit called the coulomb. 1.00 C = One coulomb = 6.24×10^{18} e. Therefore, 1e = 1.60×10^{-19} C.

The total charge on an object is given the symbol Q. Q = N e. N is the number of excess electrons or the deficit of electrons. Q is a negative or positive number. The units for Q are e or C.

Problems :

Note: Write down the answers in scientific notation. Don't forget the units! When using your scientific calculator, use the exp button. A common mistake is to type in (for example) the number 45,600 as 4.56x10exp4. This is wrong. Type in 4.56exp4.

1) An ebonite rod has an excess of 55,000 electrons. Find the charge in coulombs.

2) How many electrons are in 4.2 μC ? (μ = micro = 10^{-6})

3) A metal object has a deficit of 2.3×10^{15} electrons. Find the charge in coulombs.

4) A glass rod is rubbed with silk. The rod acquires a charge of $+6.1 \times 10^{-8}$ C. What is the charge on the silk in coulombs? Find the charge on the silk in units of e.

5) A vinyl comb has a charge of -920 μC. What is the number of excess electrons?

6) What is the charge on a neutral helium atom? What is the charge on the helium nucleus? (express in units of e and coulombs).

7) What is the charge on the nucleus of a gold atom in coulombs?

Answers : 1) -8.8×10^{-15} C, 2) 2.6×10^{13} electrons, 3) $+3.7 \times 10^{-4}$ C, 4) -6.1×10^{-8} C, -3.8×10^{11} e, 5) 5.7×10^{15} electrons, 6) zero, $+2e$, $+3.2 \times 10^{-19}$ C, 7) 1.3×10^{-17} C.