Static vs. Current

Two Kinds of Electric Charge: Positive Negative

Common particles of the atom Protons Electrons

Amount of charge on a proton or neutron..... is called the elementary charge. symbolized with "e"

Electrically Neutral means....... BALANCED + and −

Bottom of Physics Regents Reference Table page 1

<table>
<thead>
<tr>
<th>Electrostatic constant</th>
<th>$k$</th>
<th>$8.99 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 elementary charge $e$</td>
<td>$e$</td>
<td>$1.60 \times 10^{-10} \text{ C}$</td>
</tr>
<tr>
<td>1 coulomb (C)</td>
<td></td>
<td>$6.25 \times 10^{15}$ elementary charges</td>
</tr>
<tr>
<td>1 electronvolt (eV)</td>
<td></td>
<td>$1.60 \times 10^{-10} \text{ J}$</td>
</tr>
<tr>
<td>Planck's constant $\hbar$</td>
<td>$\hbar$</td>
<td>$6.63 \times 10^{-34} \text{ J} \cdot \text{s}$</td>
</tr>
<tr>
<td>1 universal mass unit (u)</td>
<td>$m_u$</td>
<td>$9.31 \times 10^2 \text{ MeV}$</td>
</tr>
<tr>
<td>Rest mass of the electron</td>
<td>$m_e$</td>
<td>$9.11 \times 10^{-31} \text{ kg}$</td>
</tr>
<tr>
<td>Rest mass of the proton</td>
<td>$m_p$</td>
<td>$1.67 \times 10^{-27} \text{ kg}$</td>
</tr>
<tr>
<td>Rest mass of the neutron</td>
<td>$m_n$</td>
<td>$1.67 \times 10^{-27} \text{ kg}$</td>
</tr>
</tbody>
</table>
Objects become electrically charged due to the movement of electrons.

Why not protons?

Two neutral objects can become electrically charged when:

1) they have different affinities for electrons
2) and they move past each other while in "contact".

The material with a higher affinity for electrons will accept electrons from the material with a lower affinity for electrons.

This is called "charging by friction".

Affinity for electrons
Triboelectric scale

PVC holds onto electrons like balloons
Latex rubber

Paper
Wool
Human Hair
Glass

loses electrons easily

more affinity for electrons

less affinity for electrons
Electric Charge is Conserved!

What's conserved in physics????

The net charge of closed and isolated systems remains constant - even when charge is transferred within the system!

Often stated as ....

"Charge can neither be created nor destroyed"
1. Charging by Friction

Charging by friction between objects of different affinities, causes the object with higher affinity for electrons to gain electrons from the other object.

The object that has "lost" electrons now has a positive charge.

In the case of the balloon and hair: the balloon has a higher affinity for electrons and takes electrons from the hair. The balloon ends up negatively charged.

The hair, however, becomes positively charged.

Although both the balloon and hair become charged, the system is still neutral. The balloon gains just as many electrons as the hair lost, so charge has not been created, just separated. This is an example of CONSERVATION OF CHARGE.
Electrical Grounding:

Occurs when an object is electrically connected to the Earth _(hence: grounding)_

When a positively charged object is grounded,
electrons move from the Earth to the object to
cause it to be neutralized

electrons
move from the Earth,
through the person to the
object
Chapter 20 Static Electricity part 1

Three methods of Static Electric Charging

1. Friction
   Charges to friction between objects of differentaffinities. Whenever the object with higher affinity for electrons gains electrons from the other object.
   The object that has "lost" electrons now has a positive charge.
   In the case of the balloon and hair, the balloon has a higher affinity for electrons and gains electrons from the hair. The balloon ends up negatively charged.
   The hair, however, becomes positively charged.

   Although both the balloon and hair become charged, the system is still neutral. The balloon gains just as many electrons as the hair lost; no charge has been created, just separated. This is an example of CONSERVATION OF CHARGE.

2. Conduction
   When charge is shared by direct contact, both objects involved end up with the same type of charge and repel each other.

   When a negatively charged tube contacts a neutral pithball, some of the tube's excess electrons move to the pithball, and the pith ball moves away due to mutual repulsion of like charges.

3. Induction
   Induction of a charge occurs when a nearby charge is used to "push" or "pull" charges off of or onto another object.

   Now when someone touches the other side of the can...
   * CHARGES
   * "pushed" or "pulled" to the right

   Now the can will have a positive charge