Electronics
Static Electricity and Static Sensitive Devices

Terry Sturtevant
Wilfrid Laurier University
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Static Electricity
Static Sensitive Devices
Static Protection

Triboelectric series

1. Materials charge when rubbing against each other according to how much affinity each one has for electrons.
Triboelectric series

1. Materials charge when rubbing against each other according to how much affinity each one has for electrons.

2. Which item becomes “positive” and which becomes “negative” will depend on where it is in the series. The farther apart items are, the more charge will transfer.
• positive
- positive
- skin
<table>
<thead>
<tr>
<th>Positive Static Sensitive Devices</th>
<th>Static Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive</td>
<td>Sparks in air</td>
</tr>
<tr>
<td>skin</td>
<td>Terry Sturtevant</td>
</tr>
<tr>
<td>leather</td>
<td>Electronics</td>
</tr>
</tbody>
</table>

**Triboelectric series**
- Positive
- Skin
- Leather

Materials: rabbit fur, glass, hair, nylon, wool, cat fur, silk, aluminum, paper, cotton.
- positive
- skin
- leather
- rabbit fur
- positive
- skin
- leather
- rabbit fur
- glass
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<th>Sparks in air</th>
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- **positive**
- skin
- leather
- rabbit fur
- glass
- hair
- positive
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- positive
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- wool
- positive
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- wool
- cat fur
Static Electricity
Static Sensitive Devices
Static Protection

Triboelectric series
Sparks in air

- positive
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- wool
- cat fur
- silk
- positive
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- wool
- cat fur
- silk
- aluminum
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- **positive**
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- wool
- cat fur
- silk
- aluminum
- paper
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- **positive**
- skin
- leather
- rabbit fur
- glass
- hair
- nylon
- wool
- cat fur
- silk
- aluminum
- paper
- cotton *about neutral*
cotton about neutral
- cotton **about neutral**
- steel
- cotton *about neutral*
- steel
- hard rubber
- cotton **about neutral**
- steel
- hard rubber
- copper
- cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- styrene (e.g. styrofoam)
cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- styrene (eg. styrofoam)
- Saran wrap
- cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- styrene (eg. styrofoam)
- Saran wrap
- polyethylene (eg. Scotch tape)
- cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- styrene (eg. styrofoam)
- Saran wrap
- polyethylene (eg. Scotch tape)
- polypropylene
- cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- styrene (eg. styrofoam)
- Saran wrap
- polyethylene (eg. Scotch tape)
- polypropylene
- vinyl
• cotton **about neutral**
• steel
• hard rubber
• copper
• polyester
• styrene (eg. styrofoam)
• Saran wrap
• polyethylene (eg. Scotch tape)
• polypropylene
• vinyl
• Teflon
- cotton **about neutral**
- steel
- hard rubber
- copper
- polyester
- styrene (eg. styrofoam)
- Saran wrap
- polyethylene (eg. Scotch tape)
- polypropylene
- vinyl
- Teflon
- **negative**
Sparks in air

1. Dry air (as in winter) allows bigger charges to build up.
Sparks in air

1. Dry air (as in winter) allows bigger charges to build up.
2. Sparks in the air require about 3000 V/mm of dry air.
Logic gates operate on a few volts.
1. Logic gates operate on a few volts.
2. Logic gates operate on small currents; mA to µA.
Static Sensitive Devices

1. Logic gates operate on a few volts.
2. Logic gates operate on small currents; mA to \( \mu \text{A} \).
3. Static charges can destroy certain kinds of chips.
1. Logic gates operate on a few volts.
2. Logic gates operate on small currents; mA to $\mu$A.
3. Static charges can destroy certain kinds of chips.
4. More expensive chips tend to be more static sensitive.
Transportation of static sensitive devices

1. Use static bags and/or foam.
Transportation of static sensitive devices

1. Use static bags and/or foam.
2. Place in breadboard instead of leaving on bench.
Use of static sensitive devices

1. Use static mat on bench.
Use of static sensitive devices

1. Use static mat on bench.
2. Attach ground lead from mat to earth ground.
Use of static sensitive devices

1. Use static mat on bench.
2. Attach ground lead from mat to earth ground.
3. Attach wrist straps.