Introduction to Electric Charge

**Wands and Pens**:

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| Take a plastic wand and rub it with some material. Holding it at the end with your fingertips, lower it and hold it next to the paper, then raise the wand again.  What happens?  Now take the wand and "wipe" it through your bare palm a couple of times. Once again hold the wand to the paper. What happened?  **Q1:**When you first pull the wand through the material there is a static electric charge present. Where do you think this charge originated from? |  |

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| **Q2:** The Coulomb force (attractive or repulsive force between charged objects) between the paper and the wand allows you to initially attract the paper and "lift" it off of the table. What must be true of the relative sizes of Coulomb force and force due to Gravity for the paper to be lifted by static electricity?  **Q3:** Why won't the wand pick up the paper after you wipe the wand through your bare hand a few times? |

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| **Q4:** What does rubbing the plastic pen or the wand over fabric do to the pen and wand?  **Q6:** Draw a free-body diagram of the paper while it is being lifted by the wand. Label the Coulomb force and force due to gravity and indicate their relative sizes.  **Advanced Question:** What must be the minimum Coulomb force present for you to lift the paper if you know its mass is 0.15 grams? |

**Charges and Sticky Tape**:

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| Tear about 10 cm of clear tape from dispenser. Stick the tape to a binder or other smooth surface and carefully peel it up. Have a partner do the same. Bring your tape close to your partner's tape.  **Q1:** Describe and sketch the interaction. Does the strength of the interaction change with the distance between tapes? | http://physicsed.buffalostate.edu/SeatExpts/EandM/charges/img/tape1.jpg |

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| http://physicsed.buffalostate.edu/SeatExpts/EandM/charges/img/tape2.jpg | To your binder or a smooth plastic surface attach a 12 cm piece of tape and label it "bottom." Place a 10 cm piece of tape labeled "top" onto the first. Peel up both together. |

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| While still together, stroke the two pieces of tape with your thumb and index finger to discharge them. Finally, carefully peel the two apart. Determine how the top and bottom pieces interact.  Now test your pieces of tape with that of other groups. | http://physicsed.buffalostate.edu/SeatExpts/EandM/charges/img/tape4.jpg |

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| **Q2:** Describe and sketch the interaction between your bottom and top piece. Does it depend on distance between the tapes, and if so how?  **Q3:** Describe and draw the interaction between your bottom and top tapes and those tapes prepared by other groups. Do they behave consistently? How many others did you try?  **Q4:** From your observations, what evidence supports the claim that two distinct types of charges exist?  **Q5:** Account for these phenomena using the 'electron fluid' model of charge behavior by sketching diagrams of the pieces of tape with charges in your report. Describe in words what tape has what charge and where it came from.  **Q6:** Describe the interaction between your bottom and top tapes in terms of conservation of charge.  **Q7:**A third piece of tape is now created. Invent and describe a test to find the type of charge on the third tape. Try it. Describe and interpret your results.  **Electrostatic Puzzler**  Take an aluminum can and a wand. Touch the aluminum can to make sure it has no charge (Grounding it) Rub the wand with some fur and bring it close to the can. What happens? Explain why this occurs.  **Post Lab Questions:**   1. You redo the experiment with the sticky tape, making 2 strips of tape that are 1 half-inch (1.2 cm) wide piece of tape 20 cm long has a mass of about 0.16g and repel each other. You find that you can float one tape over the other when they are 1.5 cm apart. Assuming that they have the same number of charges, determine how much charge each one contains. 2. A charged rod is moved to the same distance from a pair of uncharged metal spheres as shown. The spheres in each pair are initially in contact, but they are then separated while the rod is still in place. Then the rod is removed.     Rank the net charge on each sphere from most positive to most negative after the spheres have been separated and the charged rod removed.    Most Negative  Most Positive  Explain your reasoning. |

1. In each figure, two charges are fixed in place on a grid, and a point near those particles is labeled *P*. All of the charges are the same size, *Q*, but they can be either positive or negative.



Rank the strength (magnitude) of the electric force on a charge +*q* that is placed at point *P*.



Explain your reasoning.