Sticky Tape Experiments

Two students are conducting a lab investigation involving charging methods and electrostatic attraction and repulsion. The students know that oppositely charged objects attract, like charged objects repel, and charged and uncharged objects attract.

Experiment 1

In **Experiment 1**, the students place a piece of scotch tape on the table and label it **X**. They place a second piece of tape on top of tape **X** and label the top tape as **Y**. They peel the two pieces of tape off the table and then peel them apart from one another. They observe that both tapes attract neutral bits of paper. They also observe that the two tapes attract one another.

Experiment 2

In **Experiment 2**, the students rub a vinyl tube with animal fur. The vinyl tube becomes charged negatively. They bring the vinyl tube near Tape **Y** and observe that it attracts Tape **Y**.

Experiment 3

In **Experiment 3**, the students hang their two separated pieces of scotch tape from different locations on a bar above the table. They then rub a sample of ebonite (a hard rubber) with animal fur and bring it near the two tapes. They observe that the ebonite attracts neutral bits of paper. They also observe that the ebonite repels tape **X** and attracts tape **Y**.

Experiment 4

In **Experiment 4**, the students rub a sample of acetate with Saran™ wrap. They bring the acetate near tape **Y** and observe that it repels tape **Y**.

Questions:

1. Which of the following conclusions can be drawn from the data presented in **Experiment 1**?
   a. Tape **X** is charged with a negative type of charge.
   b. Tape **Y** is charged with a positive type of charge.
   c. Tapes **X** and **Y** have the same type of charge.
   d. Tapes **X** and **Y** have the opposite type of charge.

2. Which observation is crucial to determining the type of charge on Tape **Y**?
   a. **Experiment 1**: Tapes **X** and **Y** attract one another.
   b. **Experiment 1**: Tapes **X** and **Y** both attract neutral paper bits.
   c. **Experiment 2**: The negatively charged vinyl sample attracts Tape **Y**
   d. **Experiment 3**: The ebonite repels tape **X** and attracts tape **Y**.

3. Which one of the following observations would you expect to observe?
   a. The ebonite from **Experiment 3** repels Tape **X**.
   b. The vinyl from **Experiment 2** repels neutral bits of paper.
   c. The ebonite from **Experiment 3** repels neutral bits of paper.
   d. The vinyl from **Experiment 2** attracts the ebonite from **Experiment 3**.

4. Which one of the following observations would you **NOT** expect to observe?
   a. The acetate from **Experiment 4** attracts Tape **X**.
   b. The ebonite from **Experiment 3** repels the neutral paper bits.
   c. The vinyl from **Experiment 2** repels the ebonite from **Experiment 3**.
   d. The ebonite from **Experiment 3** attracts the acetate from **Experiment 4**.

5. An object is brought near the two tapes and is observed to attract both Tape **X** and Tape **Y**. What conclusion can be drawn regarding the object?
   a. It is a neutral object.
   b. It has the same type of charge as Tape **X** and Tape **Y**.
   c. It has the opposite type of charge as Tape **X** and Tape **Y**.
   d. It is a charged object, but its type cannot be determined from these tests.

6. An object is brought near Tape **Y** and observed to repel Tape **Y**. What interaction could be predicted between this object and Tape **X**?
   a. The object would attract Tape **X**.
   b. The object would also repel Tape **X**.
   c. There would be no interaction between the object and Tape **X**.
   d. There is not enough information to make such a prediction.

7. Which one of the following accurately describes the type of charge on Tape **X**, Tape **Y** and the ebonite?

a. Tape **X**: negative	Tape **Y**: positive	Ebonite: positive
b. Tape **X**: negative	Tape **Y**: negative	Ebonite: negative
c. Tape **X**: negative	Tape **Y**: positive	Ebonite: negative
d. Tape **X**: positive	Tape **Y**: negative	Ebonite: positive

8. After testing the acetate in **Experiment 4** with Tape **Y**, one of the students suggested that they also needed to test the acetate's interaction with Tape **X** if they wish to determine the type of charge on the acetate. Would this be a necessary or unnecessary test?
   a. This is a necessary step because the test with Tape **Y** only indicates that the acetate is charged.
   b. This is a necessary step because the acetate could also be neutral; a second test is required to confirm or deny this possibility.
   c. This is a unnecessary step because a second observation could provide a contradictory result and suspend a conclusion.
   d. This is an unnecessary step because if two objects repel each other then one knows for certain that both the objects are charged with same type of charge.

9. If the acetate from **Experiment 4** were brought near Tape X instead of Tape Y, what interaction – attraction, repulsion, or none – would have been observed?
   a. Attraction would have been observed.
   b. Repulsion would have been observed.
   c. No interaction would have been observed.
   d. It is impossible to predict the interaction since the charge on acetate is not known.

10. Only a single test was performed with the acetate from **Experiment 4**. Which one of the following tests and observations would be observed for the acetate if other tests were performed?
   a. The acetate would also repel Tape **X**.
   b. The acetate would repel neutral paper bits.
   c. The acetate would attract the vinyl from **Experiment 2**.
   d. The acetate would repel the ebonite from **Experiment 3**.

11. After conducting these four experiments, two students begin conducting further studies using a variety of materials. They rub a pole of unknown material on their shirt and bring it near the vinyl from **Experiment 2**. The vinyl and unknown material attract each other. Student A claims the pole is charged. Student B insists that they also test the interaction of the pole with neutral paper bits. Why would it be important to follow Student B's advice?
   a. Nonsense! Student B's advice is unnecessary. The pole is definitely charged if it attracts Tape **Y**.
   b. It is possible that the pole is neutral; testing its interaction with paper bits would confirm or deny this possibility.
   c. The first test is the evidence that the pole is charged. But testing the pole's interaction with paper bits will reveal the type of charge.
   d. It is possible that the vinyl is doing the attracting and that the pole is not attracting back; the pole must be tested against the less aggressive paper to know for sure.