LAB: Static Electricity Labs Name _____

Part A: Basics

Subatomic Particles

Particle	**Charge**	**Location**	**Able to move?**
Electron	Negative	Outside of nucleus	YES!
Proton	Positive	Nucleus	NO!
Neutron	Neutral (no charge)	Nucleus	NO!

Charge Rules
Opposite Charges ATTRACT Like Charges REPEL

For **A.1-A.6**, say whether the charges attract or repel:

A.1 positive and positive

A.2. positive and negative

A.3. negative and negative

A.4. proton and proton

A.5. proton and electron

A.6. a pile of electrons (do they attract or repel each other?)

A.7. Why do electrons usually stay near the nucleus of an atom? [but, are able to leave if a better option comes along.]

A.8 Answer using the words "protons, electrons, and/or neutrons"
An object has a positive charge if there are more _____ than

_____

A.9 Answer using the words "protons, electrons, and/or neutrons"
An object has a negative charge if there are more _____ than

_____

A.10 How can something acquire a negative charge? (What needs to happen?)

A.11 How can something acquire a positive charge? (Remember that some of the subatomic particles *cannot move*!)

Insulators and Conductors

Conductor A material that allows electrons to move easily. Made from metal.
Insulator A material that does not allow electrons to move easily. Most everything not made of metal is an insulator.

For **A.8 – A.14** say whether the material is a conductor or an insulator.

A.12 Copper wires

A.13 Rabbit fur

A.14 Plastic

A.15 A metal doorknob

A.16 Rubber gloves

A.17 A metal bookshelf

A.18 Hair

Static Electricity vs. Current Electricity

Static Electricity	**Current Electricity**
Electrons jump from one *insulator* to another, making sparks and tingly feelings.	Electrons flow continuously on a conductor, doing things such as lighting bulbs.

For **A.15 – A.20**, state whether this statement applies to *static* or *current* electricity.

A.19 Electrons flow through wires.

A.20 Electrons jump around, creating sparks.

A.21 Involves most conductors.

A.22 Involves most insulators.

A.23 Causes tingly feelings and makes you say “ouch!.

A.24 Makes a light bulb light.

Special Note! In this class, try not to use the word “static” to describe static electricity! Instead, write specifically about what electrons are doing.

Basic Electrostatic methods

Charging By Friction When you rub two *insulators* together, often electrons move from one insulator to another. Typically, some insulators want to hold onto electrons more than others, and those sometimes will take electrons away.
Electrostatic Discharge Electrons, trying to get away from each other, jump through the air from an insulator to a conductor, making a *shock*.
Charging by Induction One item has a charge, and it creates a charge in a nearby object without touching or any electrons being exchanged. This happens because it causes electrons to move to the back of the nearby object.

Method	**Do two things touch?**	**Are electrons exchanged?**
Charging by friction	YES	YES
Electrostatic Discharge	NO	YES
Charging by Induction	NO	NO

For **A.25 – A.31** answer true or false.

A.25 Friction happens whenever things rub together.

A.26 Often, when there is friction, electrons move between objects.

A.27 Charging by friction happens when you rub together *conductors*.

A.28 Charging by friction happens when you rub together *insulators*.

A.29 In electrostatic discharge, electrons jump onto another *insulator*.

A.30 In electrostatic discharge, electrons jump onto a *conductor*.

A.31 Electrostatic discharge happens because electrons repel each other.

Part B: Rabbit Fur Lab

Step 1: Rub the rabbit fur and PVC pipe together:

How electrons move When you rub the fur and the pipe, Electrons move form the fur to the pipe!
How electrons move in this lab (more advanced) The PVC pipe and rabbit fur are both insulators. However, the PVC pipe, because of the way its molecules are put together, desires electrons *more* than the rabbit for. Thus, when you rub them together, the electrons jump from the rabbit fur to the PVC pipe. Once they get there, they cannot leave easily, because the PVC pipe is an insulator.

B.1 What do you feel and hear when the electrons are rubbed against the PVC pipe?

B.2 Draw the rabbit fur being rubbed against the PVC pipe. Draw the electrons jumping from one to the other:

B.3 What is the name of this process?
A. electrostatic discharge

B. charging by friction

C. charging by induction

B.3. When you feel tingles while rubbing the fur against the PVC pipe, what do you think you are feeling?

B.5 After you charge the PVC pipe, hold your hand near the pipe and move it up and down. What does you hand feel like? What do you think it is?

B.6: Step 2: Put the *charged* PVC pipe near the rabbit fur, what happens? Explain and draw what happens:

B.7 (Explaining **B.6**)When they are rubbed together, the PVC pipe has collected electrons from the rabbit fur.
B.7a What is the charge of the PVC pipe?

B.7b What is the charge of the rabbit fur?

B.7c Should the rabbit fur and PVC pipe attract or repel? Why?

B.7d. Is this what happens in real life?

B.7e. Draw the rabbit fur near the PVC pipe. Make sure to draw and label *charges*.

Step 3: Electrostatic Discharge:

The PVC pipe is full of electrons. They want to get away! So, if they are brought near a *conductor*, which would allow them to move away from each other very fast, they will jump through the air to reach that conductor.

B.8 What process is described in the box above? (It's a vocabulary word on page 3).

B.9 What happens when you move the charged PVC pipe near a doorknob? Try with the lights off and very slowly and carefully.

B.10 Draw the electrons jumping off of the PVC pipe to reach the doorknob.

Step 4: Charging by Induction

B.11 Charge the PVC pipe and then bring it close to your hair. What happens? [It works best if you have longer hair and are very patient.]

Charging by Induction

1. The PVC pipe is negatively charged. It's full of electrons.

2. The PVC pipe goes near your hair. It *repels* the electrons inside your hair. They run away.

3. Your hair is now positively charged. (by induction!)

4. The PVC pipe and your hair are attracted.

B.12
Draw what happens when the negatively charged PVC pipe is brought near your neutrally charged hair. Label what happens to the electrons inside the hair, and what the hair does afterwards?

Part C: Simulations
To get to the correct website, Google "Phet Physics Online" it will be the first link.
PART 1: JOHN TRAVOLTAGE!

C.1 What do the little negative signs represent?

C.2 How do you get the little negative signs to fill up in Travolta's foot? What is the name of this process?

C.3 Do electrons attract or repel each other? When Travolta fills with electrons, what do they want to do?

C.4 What causes an electrostatic discharge (a shock)?

C.5 How can you make Travolta fill up with electrons without incurring any electrostatic discharge?

C.6 How can you make electrostatic discharge happen as soon as the electrons enter Travolta?

PART 2: BALLOONS AND STATIC ELECTRICITY

C.7 What do the positive signs represent?

C.8 What do the negative signs represent?

C.9 Which of the two can move, negative or positive signs? Why?

C.10 Rub the balloon against the sweater. What happens to electrons?

C.11 What do we call this process after they balloon is rubbed against he sweater?

C.12 The balloon plays the role of the
A) PVC pipe
B) rabbit fur

C.13 The sweater plays the role of the:
A) PVC pipe
B) rabbit fur

C.14 After the balloon rubs against the sweater, the balloon is ___negative/positive___. The sweater is ___negative/positive___. Because the charges are ___like/opposite___, the balloon and sweater ___attract/repel___.

C.15 When the balloon is *charged* and goes near the wall, what happens to the electrons on the wall? Why?

C.16 Is the balloon attracted or repelled from the wall? Why?

C.17 What did we call the process that takes place in the wall?

C.18 Switch to the mode with *two* balloons, and figure out a way to get them to repel *each other*. Explain here:

Answers

A.1 repel

A.2. attract

A.3. repel

A.4. repel

A.5. attract

A.6. repel

A.7. The electrons on the outside of the atom are negative. The protons inside the nucleus are positive. They are opposite charges, so electrons are attracted to the nucleus.

A.8 Conductor

A.9 Insulator

A.10 Insulator

A.11 Conductor

A.12 Insulator

A.13 Conductor

A.14 Insulator

A.15. True

A.16. True

A.17. False

A.18. True

A.19. False

A.20. True

A.21. True
B.2 charging by friction

B3. There isn't one right answer, it feels however it feels to you! For most people, the pipe feels tingly when you rub the fur against it. This is caused by the electrons jumping to the rabbit fur.

B.6 Electrostatic Discharge