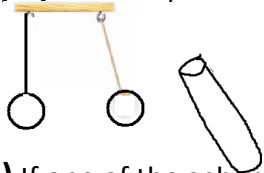
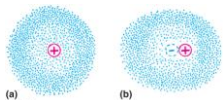


1) a) Rub the plastic rod with wool. Is the rod charged? How do you know?



b) If one of the spheres has a net negative charge and the other is neutral, what happens if the spheres are close together but do not touch?



c) If the spheres are allowed to touch, then what happens?

d) Rub 2 balloons with wool. Make a few measurements to estimate the number of extra electrons on the balloons. Hint: Free-body diagram.

BONUS. (Difficult to do. Leave until the end if there's time, or look it up)

The **plastic** rod rubbed with **wool** has _____ charge.

The **plastic** balloon rubbed with **wool** has _____ charge.

The **glass** rod rubbed with **silk** has [negative][positive] charge.

Hint: Use a balloon tied to a string, the rods, and the cloths to help you.

Explain/draw what you did!

2) **Abra-cadabra** a) Use induction to get the wings of the electroscope to float horizontally. You may only **GENTLY** touch the metal top once and for half a second. Describe what you did.

b) After the wings are horizontal, devise an experiment to see if the charges on them are positive or negative. Draw what you did.

3) [5 Van de Graaff Experiments](#). Watch video. Draw a picture with charges.

1) Hair

[friction][induction][conduction][discharge]

4) fluorescent light

[friction][induction][conduction][discharge]

2) Cupcake

[friction][induction][conduction][discharge]

5) bubbles

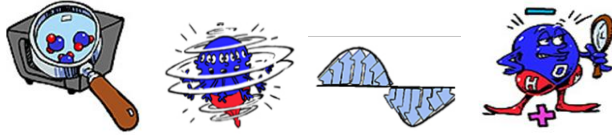
[friction][induction][conduction][discharge]

3) lightning

[friction][induction][conduction][discharge]

4) Everyday Electric Fields

a) How does a microwave heat food up?

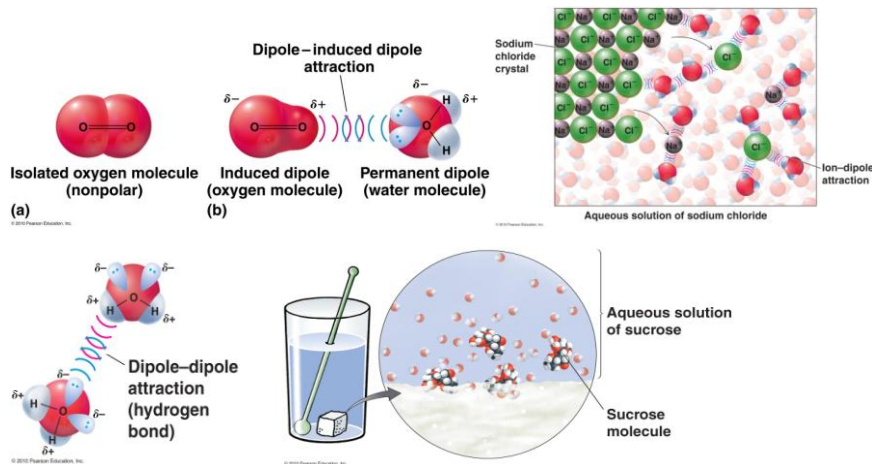


b) How do cosmetics stick?



c) Why is it difficult to get a cell phone signal in the elevator?

d) Chemical bonds are mainly electrical in nature. Molecular attractions are also electrical, but the strongest molecular attractions are much weaker than chemical bonds. Rank the following from strongest to weakest attraction, and give an example of each: dipole-dipole, ion-dipole, dipole-induced dipole (What does electricity have to do with how fish breathe, sugar-water, why oil and water don't mix, and why you don't need soap to wash your hands?)



CIRCUITS

C1) Remove the bulb from the mini socket.

a) Draw and label a diagram of the bulb and label these parts:

- glass bulb
- filament leads

(tiny wires that lead to the filament)

- screw base
- base contact (made of lead)
- lead separator (glass bead)

b) Using a bare bulb (out of its socket), one battery, aluminum foil, and a metal cup, try to light the bulb in as many ways as you can.

Draw a picture: “works” “doesn't work”

C2) a) To measure current flowing through a load, you use a [ammeter][voltmeter] and connect it in [series][parallel] to the load.

Draw a diagram:

b) To measure voltage across a load, you use a [ammeter][voltmeter] and connect it in [series][parallel] to the load. Draw a diagram:

C3) a) Build a **series** circuit with 1 battery and 2 light bulbs. Draw a diagram of your circuit. a) Label and measure, including units and any calculations: V_1 , V_2 , V_B , I_1 , I_2 , I_B , R_1 , R_2 , R_{eq} .

b) How are the 9 quantities above theoretically related?

c) How do your measurements compare to theory? Give good reasons why they might be different from the ideal.

d) If you remove a bulb in series, what happens?

e) Conceptually explain why the equivalent resistance of a series circuit is always greater than the greatest individual resistor.

C4) a) Build a **parallel** circuit with 1 battery and 2 light bulbs. Draw a diagram of your circuit. a) Label and measure, including units and any calculations: V_1 , V_2 , V_B , I_1 , I_2 , I_B , R_1 , R_2 , R_{eq} .

b) How are the 9 quantities above theoretically related?

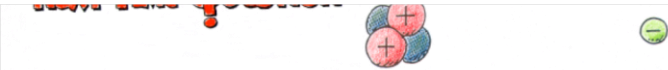
c) How do your measurements compare to theory? Give good reasons why they might be different from the ideal.

d) If you remove a bulb in parallel, what happens?

e) Conceptually explain why the equivalent resistance of a parallel circuit is always less than the smallest individual resistor.

f) Compare the brightness of the bulbs when connected singly to the battery, two in series, and two in parallel. Explain.

C5)



Two oppositely charged particles, an alpha particle with 2 positive charges and a less-massive electron with a single negative charge are attracted to each other. Compared to the force that the alpha particle exerts on the electron, the electron exerts a force on the alpha particle that is

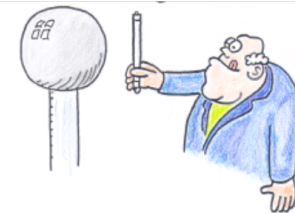
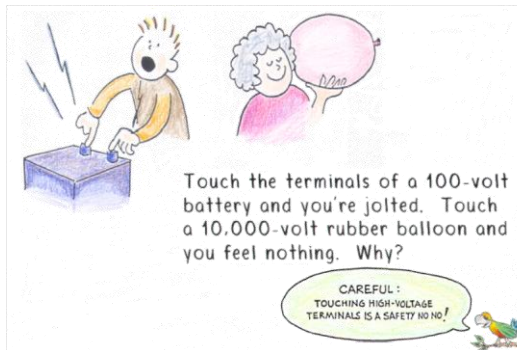
- a) greater. b) the same. c) less.

The particle with the most acceleration is the

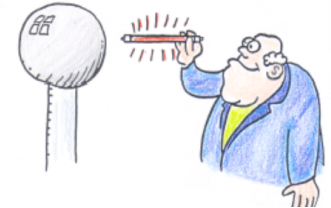
- d) alpha particle. e) electron. f) same for each.

As the particles get closer to each other, each experiences an increase in

- g) force. h) speed. i) acceleration.
j) all of the above. k) none of the above.

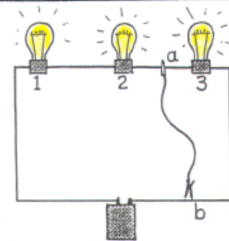


The lamp will not glow when it is held with both ends equidistant from the charged Van de Graaff generator. But when one end is closer to the dome than the other end, a current is established and it glows. Why?



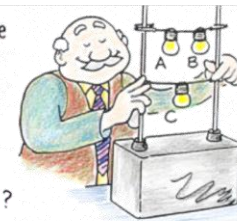
Next-Time Question

The simple series circuit consists of three identical lamps powered by a battery. When a wire is connected between points a and b,



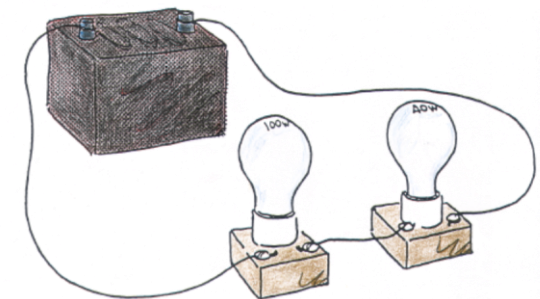
- what happens to the brightness of lamp 3?
- does current in the circuit increase, decrease, or remain the same?
- what happens to the brightness of lamps 1 and 2?
- does the voltage drop across lamps 1 and 2 increase, decrease, or remain the same?
- is the power dissipated by the circuit increased, decreased, or does it remain the same?

Three identical lamps of resistance 12 ohms are connected to the 12-V automobile battery demo as shown.



- What is the current in each lamp?
- What is the voltage across each lamp?
- What is the power dissipated in each lamp?
- How does the power dissipated in lamp C change if lamp A is unscrewed?
- What happens to the power dissipated in lamp A if lamp C is unscrewed?

The 40-watt bulb and the 100-watt bulb are connected in series to the battery. Which bulb will glow brighter?



WIRING ACTIVITY

a) Draw a floor plan of our classroom. Include: ceiling lights, light switches, fan and switch, air conditioning, 5 tables' plugs, circuit breaker box.

Draw wires using colored lines. Red = +110 V live wire, Blue = 0V neutral, Green = ground wire.

Circle all switches in yellow.

b) Your 3 appliances

Appliance:	Appliance:	Appliance:
P =	P =	P =
I =	I =	I =
V =	V =	V =
R =	R =	R =

c) Gather your teammates' appliances too. Show (with numbers), a list of appliances that if all plugged in at the same table would cause circuit overload and trip the circuit breaker.

d) Estimate the cost of the classroom's electricity usage for one month. You may need to look up some numbers.

Appliance	hours per day	hours per month	Power kW	Energy kWh

$$\text{NT} \frac{\text{electricity bill}}{\text{Total kWh}} = \text{NT } 2 \times \text{Total kWh}$$

e) What is a GFCI and how is it different from a circuit breaker?