Virtual Laboratory

Topic 09 – Electricity

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Name	Section #	Date	Topic #

PHET Electrostatics

Part I

1. Google PHET Balloons and Static Electricity Link. Or use this link http://phet.colorado.edu/en/simulation/balloons
2. Click the Playbutton or Run Now.
3. Check **Show all Charges**. Nothing else should be checked.
4. Rub the balloon on the shirt by clicking on the balloon. and dragging it.
5. What overall charge does the balloon now have? _____
6. What overall charge does the shirt now have? _____
7. What happens when you drag the balloon away from the shirt and let it go? _____
8. Why? _____
9. Click the **Reset** button on the lower left.
10. Check the **Wall** box. (The Show all Charges should remain checked.)
11. Rub the balloon on the shirt again.
12. What happens to the negative charges in the wall when you move the balloon near it?

    _____

13. What happens to the positive charges in the wall when you move the balloon near it?

    _____

14. Why don't all the positive charges move toward the balloon? _____
15. Hold the balloon in between the wall and shirt and release it
16. Why doesn't the balloon just stay in the middle? _____

    _____

    Close the program.

Part II

17. Google PHET John Travoltage or use this link http://phet.colorado.edu/en/simulation/travoltage
18. Click the Play button or Run Now.
19. Experiment with rubbing Travolta's foot against the carpet and touching his finger to the door handle. (Click on the foot or finger and drag.)
20. Place his finger on the door and rub his foot vigorously on the carpet.
21. What happens? _____
22. Move his finger away from the door knob and build up another charge.
23. What happens? _____
24. Which of the following two statements is true? A or B? _____

    A. Most electrons will go into the knob and down to the earth.

    B. Some electrons will go from the earth through the knob and into the man.
25. Why are shocks worse when you touch conductors rather than insulators? _____

    _____
26. If you take your hat off on a dry winter day. sometimes your hair will stand up. Explain this phenomenon.

    _____

Part III

27 Google PHET Electric Hockey or use this link http://phet.colorado.edu/en/simulation/electric-hockey 28

Click on the Play button or Run Now.

29 The goal of this game is to get the black positive puck to go in the goal.

30 How can you set up just one negative charge to score a goal? Test your idea. (Remember to click **Start**.) Describe what you did to score the goal.

_____

31 Click **Clear** each time you try a new set up. **Reset** if you want to retry your current set up.

32 How can you set up just one positive charge to score a goal? (The puck must remain positively charged.)

_____ 33

Reset. Check the **Field** box.

34 Place the puck near a + charge. Replace the + charge with a – charge. Notice how the field lines are different for the two situations. Use what you observed to explain why like charges repel and unlike charges attract.

35 Now play the game. You can practice a little bit if you want.

36 Set difficulty to 1. then 2. then 3. Remember to press PLAY to observe what happens. When you beat each level (when you score a goal). draw your set up just using + and - signs. Hint: Leaving the field box checked might help you.

37 Level 1 set up:

38 Level 2 set up:

39 Level 3 set up (only for those who like a challenge!):

Ohm's Law Pre-Lab Prep **(ε = IR)**

You must show all your work to receive credit. You must indicate the formula. and then rewrite the formula with the numbers. Show all mathematical steps!

1) If the voltage is 12 V and the resistance in the wire is 3 Ω. what is the current in the circuit? A. 6 Amps
   B. 2 Amps
   C. 12 Amps
   D. 4 Amps
   E. 36 Amps

2) If the resistance in the circuit is 10 Ω and the current is 3 Amps. what is the voltage of the battery? A. 3 V
   B. 10 A
   C. 30 V
   D. 3.33 V
   E. 0.3 V

3) If you connect a 7 V battery to a wire and measure the current to be 2 mA. what is the resistance of that wire? A. 35 V
   B. 14 A
   C. 14 Ω
   D. 3500 Ω
   E. 2000 Ω

4) If you connect a wire with 18 Ω of resistance to a battery. and measure the current to be 10 A. what is the voltage of the battery?
   A. 18 Ω
   B. 1.8 V
   C. 240 V
   D. 190 A
   E. 180 V

5) If the voltage of the battery is 5 V and the resistance in the circuit is 2.5 Ω. What is the current? A. 2 A
   B. 12.5 A
   C. 2.5 A
   D. 50 V
   E. 0 V

6) What is the resistance in the circuit that is connected to a 63 V battery. and is measured to have a current of 9 A.
   A. 10 A
   B. 7 Ω
   C. 657 Ω
   D. 63 Ω
   E. 7 V

7) If the current equals to 14 A and the resistance is 3 Ω. what is the voltage of the battery? A. 4.66 V
   B. 10 A
   C. 42 V
   D. 3 V
   E. 26 Ω

8) What would happen to the current in the circuit. if the voltage increases?

9) What will happen to the current. if the resistance increases?

Power (P = VI) (You must show all your work to receive credit!)

Calculate the Power for Problems 1 – 7 on the previous page. Remember to include units!

10)_____

11)_____

12)_____

13)_____

14)_____

15)_____

16)_____

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ELECTRICITY

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Part A - Static Electricity (Charge a balloon.)

Rubbing

1.(5) Describe the production of static charge through rubbing._____

2.(5) Describe the movement of static charge on a non-conductor. _____

Contact

3.(5) Describe the motion of the "peanut" and the transfer of static charge produced through contact. . _____

Induction

4.(3) Motion of the yardstick with uncharged balloon. . _____

5.(6) Motion of the yardstick with charged balloon. . _____

6.(7) Describe the induction of charge in the yardstick by the charged balloon. . _____

7.(6) What happens when a charged balloon is rubbed with a damp hand? . _____

8.(6) What is the effect of damp weather? . _____

Part B - Bringing the Three Ways of Producing Static Charges Together

1.(5) What happens when finger touches pan? . _____

2.(6) What happens when bulb touches pan? . _____

3.(7) Why does this happen? . _____

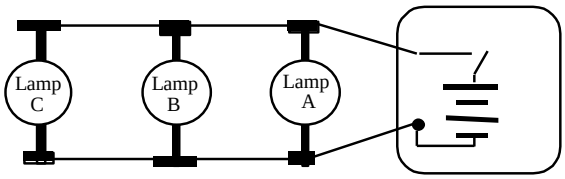
Part C - Electric Circuits

Section 1 - Identifying The Characteristics Of Parallel Circuits

1.(2) Describe the bulbs with circuit closed. . _____

2.(3) Describe the bulbs with bulb A unscrewed . _____

3.(4) Describe the bulb with bulb B unscrewed . _____



Parallel Circuit

4.(6)

Location	Voltage
A1A2 -- Lamp A	
B1B2 -- Lamp B	
C1C2 -- Lamp C	
Across Power Supply (Entire Circuit)	

5.(6a) How does the voltage across the lamps compare? _. _____

6.(6b) How does the voltage of each lamp compare with the voltage of the power supply? . _____

7.(9)

Location	Current	bulb	Current
A_1B_1 -- Lamps B & C		A	
B_1C_1 -- Lamp C		B	
A_1 Power Supply -- Lamps A & B & C (Entire Circuit)		C	

8.(10) Describe the current throughout the circuit

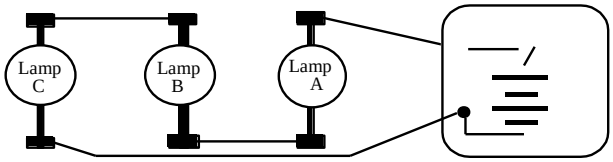
How does the current change? . _____

Section 2 - Identifying the Characteristics of a Series Circuits

1.(2) Describe the bulbs with circuit closed . _____

2.(3) Describe the bulbs with bulb A unscrewed . _____

3.(3) Describe the bulb with bulb B unscrewed . _____



Series Circuit

4.(4)

Location	Voltage
A1A2 -- Lamp A	
B1B2 -- Lamp B	
C1C2 -- Lamp C	
Across Power Supply -- (Entire Circuit)	

5.(4a) How does the voltage across the lamps compare? . _____

6.(4b) How does the voltage of each lamp compare with the voltage of the power supply? . _____

Describe how the voltage changes? . _____

7.(6)

Location	Current
A2B2 -- Lamps B	
B1C1 -- Lamp C	
A1 Power Supply -- Lamps A & B & C (Entire Circuit)	

8.(7) Describe the current throughout the circuit. . _____

How does the current change ? . _____

Part D - Comparing Series and Parallel Circuits

1.(1) Which circuit (series or parallel) is the brightest? _____

2.(2) Which circuit (series or parallel) is the dimmest? _____

3.(3) From which circuit did removing one bulb cause the others to go out? _____

4.(4) From which circuit did removing one bulb not cause the others to go out? _____

5.(5) List the general requirements needed for any circuit to function. _____

6.(6) Describe and compare voltage in parallel and series circuits _____

7.(7) Describe and compare current in parallel and series circuits. _____

Part E - Using Ohm's Law ε = IR

Section 1 - How can we measure voltage. current. and resistance?

	Resistance Coils				
Description	**A** or **1**	**B** or **2**	**C** or **3**	**D** or **4**	**E** or **5**
Length	10m	10m	20m	20m	10m
Wire Diameter (Gauge)	22	28	22	28	22
Substance	Copper	Copper	Copper	Copper	German Silver
Voltage (Volts)					
Current (Amperes)					
Resistance (Ohms)					

Note: Number 22 gauge wire has twice the diameter of number 28 gauge wire.

Section 2 - Does resistance depend on length? _____

1. (1) Compare the resistance for coils A and C. . _____
2. (2) What is the effect of length on resistance? . _____
3. (3) Compare the resistance for coils B and D. _____

Section 3 - Does resistance depend on diameter? _____

1. (1) Compare the resistance for coils A and B.
2. (2) What is the effect of diameter on resistance?
3. (3) Compare the resistance for coils C and D._____

Section 4 - Does resistance depend on the kind of material? _____

1. (1) Compare coils A and E. _____
2. (2) What is the effect of material on resistance? _. _____

Part F - How much Power? P = ε x I

Resistance Coils

Coil	Voltage (Volts)	Current (Amperes)	Power (Watts)
A			
B			
C			
D			
E			

Parallel Circuit

6.(3) Parallel Circuit

Bulb	Voltage (Volts)	Current (Amperes)	Power (Watts)
A			
B			
C			

Series Circuit

7.(3) Series Circuit

Bulb	Voltage (Volts)	Current (Amperes)	Power (Watts)
A			
B			
C			