Electrostatics Demos

AP Physics

Explain what happened.

Keywords: friction, induction, conduction

1) a) Pith balls, plastic rod, wool observations

   b) Get the pith balls to repel each other.

2) a) Get the balloon to stick on the wall

   b) Put moisture on the balloon. Still sticks?

3) Knowing the wool gives electrons to the balloon, figure out if the silk makes the glass rod positive or negatively charged.

4) Van de Graaff Generator Video

   a) Hair b) cupcake tins c) lightning

   d) fluorescent light e) bubbles

5) Get the electroscope wings to stay up horizontally. You may only touch the metal once and for less than half a second.

6) a) Which of the 4 basic forces is the contact force?

   b) How does a microwave heat food up?

   c) Is it better to wear conductive or insulating shoes at a grain silo?

   d) How does lightning form?

   e) How do lightning rods work?

   f) How to avoid static cling?

   g) Why are good thermal conductors also good electrically? Molecular level

   h) How does a CRT work?

APB Giancoli AP C EM Review Quiz

1 Ch17 Q17

A dielectric is pulled out from between the plates of a capacitor which remains connected to a battery. What changes occur to (and why)

a) the capacitance

b) charge on the plates

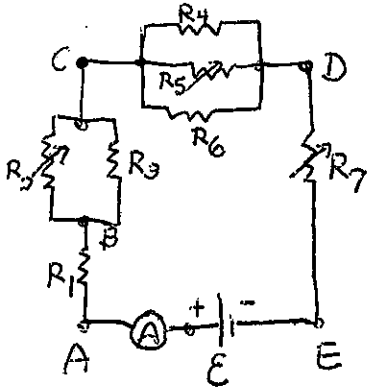
c) the potential difference

d) energy stored in the capacitor

e) the electric field

2 APB Giancoli Ch19 Q16 (also in Test)

fill in (↑ ↓ same)



a) $R_7 \uparrow \Rightarrow \Delta V_{AE}$ ____
(no resistance in Ⓐ & ℰ)

b) $R_7 \uparrow \Rightarrow \Delta V_{AE}$ ____
(there is resistance in Ⓐ & ℰ)

c) $R_7 \uparrow \Rightarrow \Delta V_4$ ____

d) $R_2 \downarrow \Rightarrow I_1$ ____

e) $R_2 \downarrow \Rightarrow I_6$ ____

f) $R_2 \downarrow \Rightarrow I_3$ ____

g) $R_5 \uparrow \Rightarrow \Delta V_2$ ____

h) $R_5 \uparrow \Rightarrow \Delta V_4$ ____

i) $R_2 \uparrow R_5 \uparrow R_7 \uparrow \Rightarrow \mathcal{E}$ ____
($r_{internal} = 0$)

3 Try Wheatstone Bridge Lab

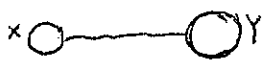
4 APB sample 24

Conducting sphere X is initially uncharged. Conducting sphere Y has twice the diameter of sphere X and initially has charge 5C. If the spheres are connected by a long thin wire, ~~which~~ when equilibrium is reached describe

a) V_X <=> V_Y

b) E_X <=> E_Y

c) Sketch $\vec{E}$. Why the direction?



d) $E_{inside\ X}$ = ____ why?

e) $Q_{inside\ X}$ = ____ why?

f) $E_{\substack{right \\ outside}\ conductor}$ = ____

APB sample 20

5 The separation between the plates of an isolated charged parallel plate capacitor is increased slightly. Fill in (↑ ↓ same) and why.

a) C ____

b) stored electrostatic energy ____

• Give the 3 expressions for energy stored in a capacitor

c) Q ____

d) force of attraction ____

e) electric field magnitude ____

• Give the expression for capacitor
$E =$ ____

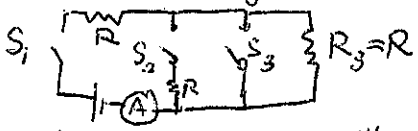
f) V ____

Expression $V =$ ____

g) energy density $u_E =$ ____ J/m^3

6 APB Sample 28.

Show why



Closing which switches will produce the greatest voltage across R_3?

A) S_1 only

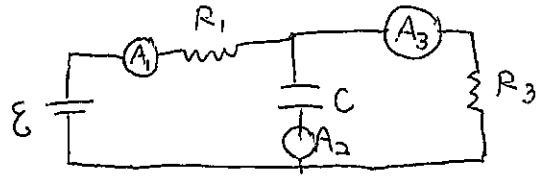
B) S_2 only

C) S_1 & S_2 only

D) S_1 & S_3 only

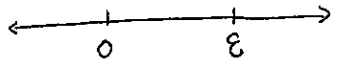
E) S_1, S_2, and S_3

AP2 MIC



16 a) Rank I_1, I_2, I_3

b) ΔV_C

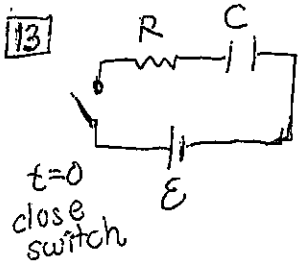


20

equipotential surfaces are shown

Rank the magnitude of E_A, E_B, E_C

13



a) At the moment the switch is closed,

$Q =$

$\Delta V_C =$

$i =$

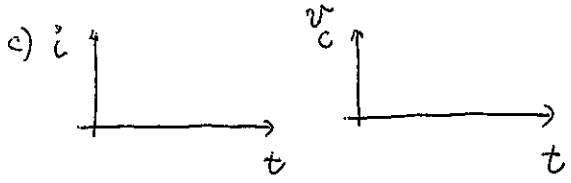
b) At steady state,

$Q =$

$\Delta V_C =$

$i =$

c)



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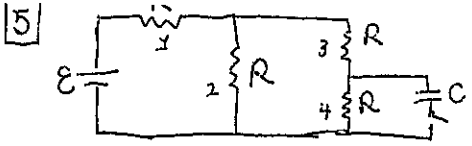


a) Switch is open

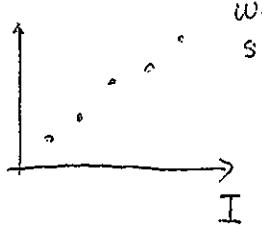
rank $\Delta V_1, \Delta V_2, \Delta V_3, \Delta V_4$

b) Right after switch is closed current through battery is I_ε.

What's I_2?

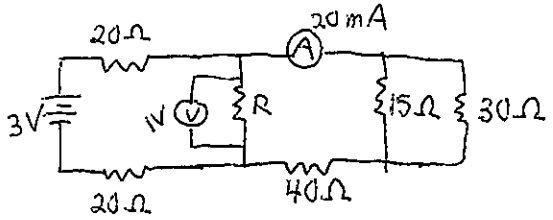
c) After a long time closed, brightness of bulb 4 compared to before the switch was closed?

21



what does the slope represent?

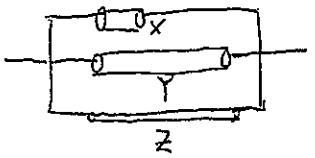
37



a) $i_{40} = ?$

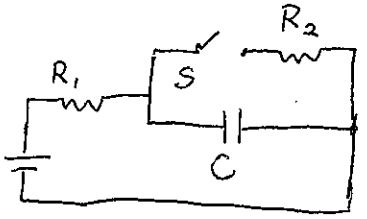
b) $R = ?$

39



rank I_X I_Y I_Z

40



Compare energy stored in C before & after the switch is closed.

Heartbook	Ckt	Statics
AP 1	#2	
~~AP 1~~	#1, 18	2,3 25
AP 1		
AP2	25	4,5,6,7,8,9 FRQ 3

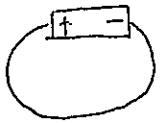
Labs

★① Is it ohmic?
2 bulbs, 3 batteries, Ⓐ, Ⓥ
How? Errors?

② Light up. Bulb, battery, Al foil

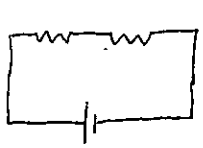
$r_{filament} \gtrless r_{wire}$

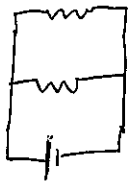
★③ Internal Resistance (Hint: ex19-1)
Short Circuit (not too long)
Ⓐ, Ⓥ



r_{wire}? $r_{battery}$?

④ 2 bulbs, 3 V, Ⓐ, Ⓥ



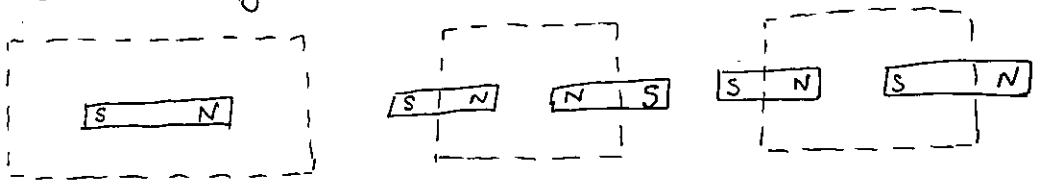


I_1? I_2? I_B?
V_1? V_2? V_B?
R_1? R_2? R_B?
Brightness?
Theory: r_{wire}

⑤ Classroom Circuit Diagram.
Will the fuse / circuit breaker trip? blow
- PIVR appliances { Laptop, water boiler, washer, μwave, light, fridge, hairdryer, heater, ac
- estimate kWh bill

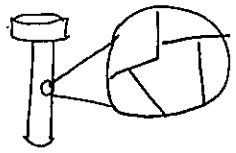
EM Demos

1) Draw the magnetic field lines

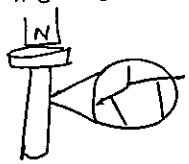


2) Sketch domains

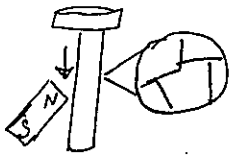
a)



b) Magnetize the iron



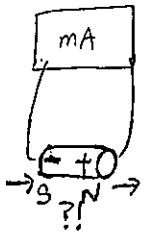
c) After Stroked



d) How to demagnetize?

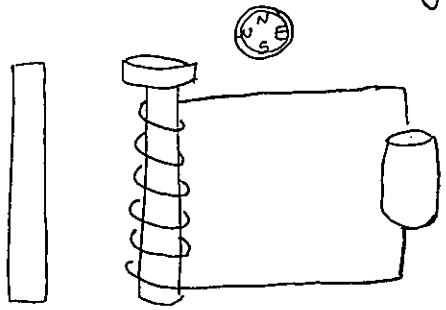
e) How does magnetite form?

3) Demo Ampere's Law. Sketch ±V, I, B



(1)

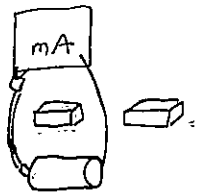
4) Create an electromagnet. Sketch ±V, I, B, N-S



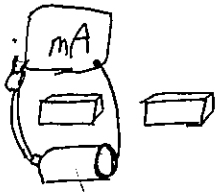
5) Demo Lorentz Force

Sketch ±, I, $\vec{B}$, N-S, $\vec{F}_B$

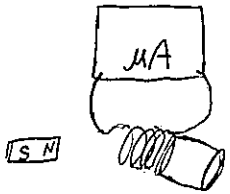
a) Pull Wire up



b) Pull Wire down



6) Demo Faraday's Law



7) Demo Motor

a) Draw

b) _____ → _____ energy

How does it work?

Demo Generator

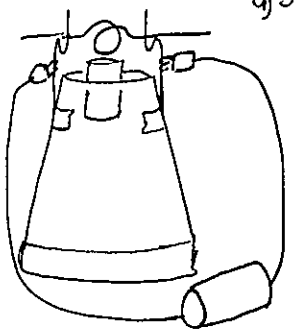
a) Draw

b) _____ → _____ energy

How does it work?

8) Build your own DC motor

a) Sketch ±V, I, $\vec{B}$, $\vec{F}$, rotatation, N-S (Lorentz force explanation)



b) Ampere's Law Reasoning:

c) How did you know what to sand off?

Term	Meaning	Picture
Magnetic force		
Magnetic Field		
Magnetic Domain		
Atom as a Magnet		
Solenoid		
Electromagnet		
Earth's Magnetic Field		

Biot-Savart Law		
How a moving charge behaves in a magnetic field		
Electric Generator		
Electric Motor		
Maxwell's Wonderful Equations		
Gauss's Law		
Gauss's Law for Magnetism		
Ampere's Law with Maxwell's Correction		
Faraday's Law of Electromagnetic Induction		