

PHYS 1444 – Section 004

Lecture #13

Monday, Mar. 26 2007

Dr. Andrew Brandt

- RC Circuits
- Magnetism and Magnetic Field
- Electric Current and Magnetism
- Magnetic Force on Electric Currents
- Magnetic Force on a Moving Charge

HW6 due Fri 3/30 at 8 pm



RC Circuits

- Circuits containing both resistors and capacitors

- RC circuits are used commonly in everyday life

- Control windshield wiper
- Timing of traffic light from red to green
- Camera flashes and heart pacemakers

- What does an RC circuit look like?

- There should be a source of emf, capacitors and resistors

- What happens when the switch S is closed?

- Current immediately starts flowing through the circuit.

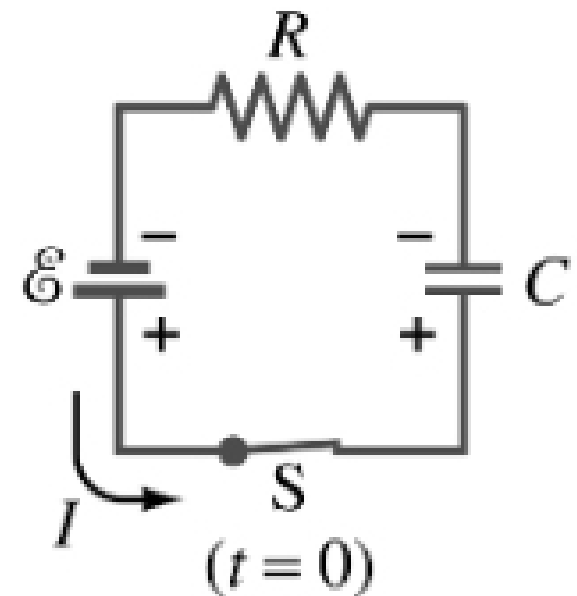
- Electrons flow out of negative terminal of the emf source, through the resistor R and accumulate on the upper plate of the capacitor

- The electrons from the bottom plate of the capacitor will flow into the positive terminal of the battery, leaving only positive charge on the bottom plate

- As the charge accumulates on the capacitor, the potential difference across it increases

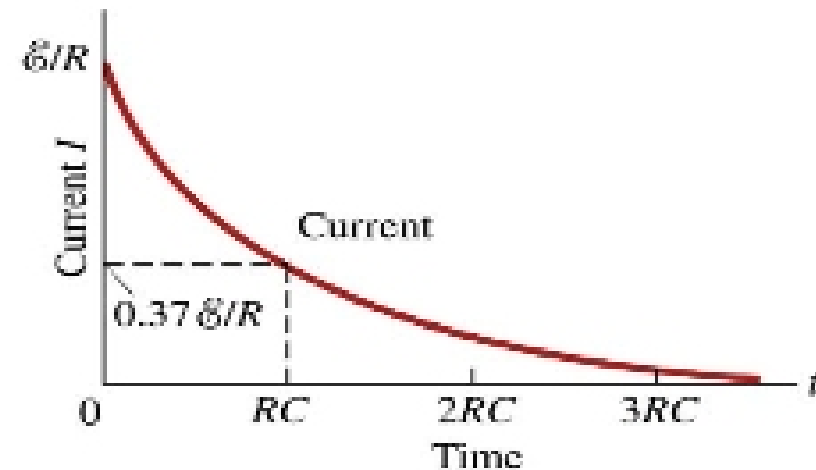
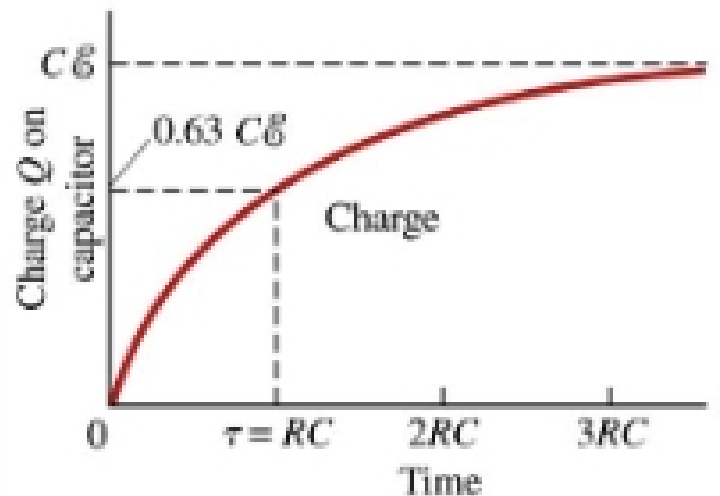
- The current reduces gradually to zero -- at that point the voltage across the capacitor is the same as that of the emf

- The charge on the capacitor increases until it reaches to its maximum $C\varepsilon$.



RC Circuits

- What does all this look like graphically?
 - Charge on the capacitor and current as a function of time



- From energy conservation (Kirchhoff's 2nd rule), the emf \mathcal{E} must be equal to the voltage drop across the capacitor and the resistor
 - $\mathcal{E} = IR + Q/C$
 - \mathcal{R} includes all resistance in the circuit, including the internal resistance of the battery, I is the current in the circuit at any instant, and Q is the charge of the capacitor at that same instant

