❖ ECE_0101(Linear Circuit & Systems)
Instructor : Jeungphill Hanne

<Education>

- **PhD, Physics**, University of California-Los Angeles, USA
  →***Majoring in Experimental Biophysics*** *(Dr. Giovanni Zocchi)*
- **MS, Physics**, University of California-Riverside, USA
- **BS, Physics**, Inha University, South Korea

<Professional Experiences>

- Aug. 2019~ : **Associate professor at ECE**, **SCUPI**
- Jul. 2010~ Aug. 2019: **Postdoctoral Research Associate**,
  The Ohio State University Wexner Medical Center, *(Adviser: Dr. Richard Fishel)*
  → ***Studying DNA Mismatch Repair by Experimental Biophysics***
- Sept. 2006~ Apr. 2010 : **Senior Research Scientist**, LG Display Co, Ltd., South Korea
  →Optical Physics, Optical/Electrical Engineering

<Research Background & Direction>

- Biophysics, Biomedical Science, Bio/Biomedical Engineering, Optical/Electrical Engineering

❖ ECE_0101(Linear Circuit & Systems)

Instructor : Jeungphill Hanne

❖ List

1. SCUPI 2023 Fall Academic Calendar

- Academic Calendar : Midterms & Final etc.
- My Schedule : Office hours etc.

2. Course Introduction

- Course information
  - Subject, Text book, Lecture Hour, Office hour, Course website, etc.
- Course Objective & Scope, Course Learning Key Points
- Course Grading & Tentative Course Schedule

3. Lab Introduction of Linear Circuit & Systems

4. Brief Introduction of Electric Circuits

1. SCUPI 2023 Fall Academic Calendar

- **Academic Calendar : Midterms & Final etc.**

SCUPI Academic Calendar for 2022-2023 Fall

	Aug.	Sep.				Oct.				Nov.					Dec.				Jan.					Feb.			
Monday	29	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	
Tuesday	30	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20	
Wednesday	31	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	
Thursday	1	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	
Friday	2	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23	
Saturday	3	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	
Sunday	4	10	17	28	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25	
SCU Week	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
SCU Term	2022 Fall Teaching Weeks																			Final Weeks		Winter Recess					

Notes:
Registration:Sept. 01 - 02
Make-up Exams: Sept 03
Classes begin: Sept 04

1st Midterm

2nd Midterm

Final

This schedule is preliminary!!

1. SCUPI 2023 Fall Academic Calendar

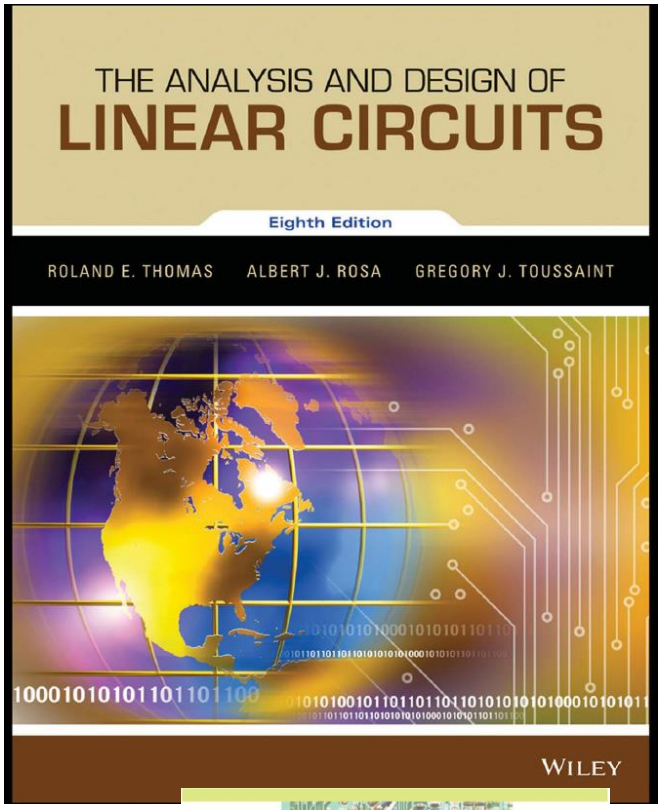
- **My Schedule : Office hours etc.**

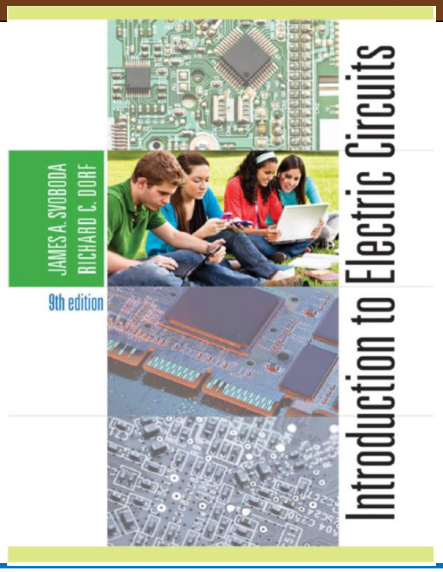
2023-2024 Fall Semester Course Schedule					
Class time	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
08:15-09:00					
09:10-09:55					
10:15-11:00			Linear circuit & System 3-104		
11:10-11:55			Linear circuit & System 3-104		
Lunch Break					
13:50-14:35	Physics 2 03 3-106				
14:45-15:30	Physics 2 03 3-106		Office Hour Physics 2 03		
15:40-16:25	Office Hour Physics 2 02		Office Hour Linear circuit & System		
16:45-17:30	Physics 2 02 3-103		Physics 2 02 3-103	Physics 2 03 3-106	
17:40-18:25	Physics 2 02 3-103		Physics 2 02 3-103	Physics 2 03 3-106	

*But, you can come to my office anytime when I am in my office ^^*

2. Course Introduction

- **Linear Circuit & Systems**
  - Learn the basics of Linear Electric circuits and its analysis methods. Construct the Linear Circuits and Measure its Electrical properties
- **Text Book**
  - The Analysis and Design of Linear Circuits, 8th Edition, Roland E. Thomas, Albert J. Rosa, and Gregory J. Toussaint, 2016 John Wiley & Sons, Inc., (ISBN: 978-1-119-23538-5)
  - Reference: Introduction of Electrical Circuits, 9th Ed. Svoboda and Dorf, 2014 (国际学生版)
  - ISBN 978-1-119-54657-3, **WILEY**
- **Lecture**
  - Instructor : Jeungphill Hanne, PhD
    jeungphill.hanne@scupi.cn
  - Office Hour: Wed.(15:40-16:25) @ 3-321A
- **TA :** Hanven Liu
  - Office Hrs : To be announced.
- **Course Format**
  - Lecture, and Lab
- **Course Grading**
  - Lecture (60~65%) and Lab (35~40%)





2. Course Introduction

• Course Scope & Objective

- Objective : Understand the basic Electric Circuits and Linear Electric Circuits, Systematically Solving Electrical properties and Construct the Linear Circuits and Measure its Electrical properties, eventually obtaining an ability to design a simple Electric Circuit.
- Scope : Electric Circuits, based on "Electricity & Magneticity" of the Physics 2 course and its
  → Required : **Basic Concepts (**the Physics 2 course) + **Some mathematical approaches!**
  1. Steady State Circuit +Linear Circuit Analysis (Constant Sources, Resistors, Op Amp)
     → Chap 1 ~ Chap 4 **: Not much for Math ! (Just simple Matrices)**
  2. Time dependent Circuit : Time dependent Sources (Voltage, Current), Capacitors, Inductors
     → Chap 6 ~ Chap 7 : **1st, 2nd Order Differential Eq.. Frequency Domain Analysis (AC)**
  3. A Mathematical tool to tackle **Sinusoidal Source Response** and **Differential Equation**
     → Chap 8 ~ Chap 9 : **Phasor and Laplace transformation**
  4. Further Application : **Network Functions** (Chap 11), **Frequency Response** (Chap 12), **Transformers** (Chap 15),**, AC Power Systems** (Chap 16).

• Course Grading : Lecture (60~65%) and Lab (35~40%)

- **Lecture Grading :** HW(15%), Quiz (5%), Midterm I (24%), Midterm II (24%), Final (25%) and Attitude(5% : Attendance, Focus, Engagement, Punctuality for HW, etc.)
- **Lab Grading :** Lab Hand out reports with HW (60%), and Two tests for Labs (Midterm (15%) & Final (15%)), and Attitude (10%, ex. Attendance, Focus, Teamwork, Working Hard, Honesty, etc.)

→ < overall 60% attendance (might be failed for the course!)

• Tentative Course Schedule

Week	ECE_0101(Linear Circuit & Systems)	Topics	Assignment
Week 1 (9/04-9/10)	Introduction & Chap 1	**Syllabus & Introduction on Electric Circuits**	
Week 2 (9/11-9/17)	Chap 1 & Chap 2	**BASIC CIRCUIT ANALYSIS**	HW1
Week 3 (9/18-9/24)	Chap 2		
Week 4 (9/25-10/01)	Chap 3	**CIRCUIT ANALYSIS TECHNIQUES**	HW2
Week 5 (10/02-10/08)	Chap 3 & Chap 4	**ACTIVE CIRCUITS**	
Week 6 (10/09-10/15)	Chap 4		HW3
Week 7 (10/16-10/22)	**Mid Term 1** & Chap 6	**CAPACITANCE AND INDUCTANCE**	
Week 8 (10/23-10/29)	Chap 6		HW4
Week 9 (10/30-11/05)	Chap 7	**FIRST- AND SECOND-ORDER CIRCUITS**	
Week 10 (11/06-11/12)	Chap 7 & Chap 8	**SINUSOIDAL STEADY-STATE RESPONSE**	HW5
Week 11 (11/13-11/19)	Chap 8		HW6
Week 12 (11/20-11/26)	Chap 9	**LAPLACE TRANSFORMS**	HW7
Week 13 (11/27-12/03)	Review & **Mid Term 2**		
Week 14 (12/04-12/10)	Chap 11	**NETWORK FUNCTIONS**	HW8
Week 15 (12/11-12/17)	Chap 12	**FREQUENCY RESPONSE**	HW9
Week 16 (12/18-12/24)	Chap 13	**Fourier Series**	HW10
Week 17 (12/25-12/31)	Chap 15	**MUTUAL INDUCTANCE AND TRANSFORMERS**	HW11
Week 18 (01/01-01/07)	Chap 16	**AC POWER SYSTEMS**	HW12
Week 19 (01/08-01/14)	Review & **Final**		
Week 20 (1/15-1/21)			

3. ECE_0101(Linear Circuit & System)_Lab Course

Instructor : Jeungphill Hanne
Lab Coordinator : Yang Yan

- **Text Book**
  - Lab Hand outs for each lab (will be download in BB)
- **Lab Coordinator**
  - Yang Yan, MS student at SCU ME
    ieuanyoung@foxmail.com
  - Office Hour/Office will be announced
- **Course Format**
  - Perform Lab (2 hour per week) with a group members and Submit Lab report with HW from Hand out
  - The total 12 labs will be executed almost every week, and two tests for labs will be offered.
- **Course Grading (Lab will cover the 35~40% of the ECE_0101 grade)**
  (Thus, the course lecture will cover the 60~65% of the ECE_0101 grade)
  - **Lab grading :**
    Lab Hand out reports with HW (60%), and Two tests for Labs (Midterm (15%) & Final (15%)), and Attitude (10%, ex. Attendance, Focus, Teamwork, Working Hard, Honesty, etc.)

Can be Flexible!

• Tentative Lab Course Schedule

Week	ECE_0101(Linear Circuit & System)	Topics	Assignment
Week 1 (9/04-9/10)	Introduction	**Introduction & Group Sorting**	
Week 2 (9/11-9/17)	Lab 1	**Equipment and Ohm's Law**	HW
Week 3 (9/18-9/24)	Lab 2	**Series and Parallel Circuits, Current and Voltage Dividers**	HW
Week 4 (9/25-10/01)	Lab 3	**Introduction to Circuit Simulation (PSPICE)**	HW
Week 5 (10/02-10/08)	No Lab		
Week 6 (10/09-10/15)	Lab 4	**Equivalent Circuits**	HW
Week 7 (10/16-10/22)	Lab 5	**Power Transfer in Circuits**	HW
Week 8 (10/23-10/29)	Lab 6	**Oscilloscope and Waveform Generator**	HW
Week 9 (10/30-11/05)	Break		
Week 10 (11/06-11/12)	**Mid Term**	**Range : Lab1-Lab6**	
Week 11 (11/13-11/19)	Lab 7	**Transient Response of RC Circuits**	HW
Week 12 (11/20-11/26)	Lab 8	**Transient Response of Second-Order Circuits**	HW
Week 13 (11/27-12/03)	Lab 9	**AC Phasor Circuit Analysis**	HW
Week 14 (12/04-12/10)	Break		
Week 15 (12/11-12/17)	Lab 10	**Ideal Transformers**	HW
Week 16 (12/18-12/24)	Lab 11	**Reactive Power Lab**	HW
Week 17 (12/25-12/31)	Lab 12	**Frequency Response of Circuits (Part I and II)**	HW
Week 18 (01/01-01/07)	Break		
Week 19 (01/08-01/14)	**Final**	**Range : Lab7-Lab12**	
Week 20 (1/15-1/21)			

4. Brief Introduction of Electric Circuits

- What is the Electric currents and the Electric voltages?

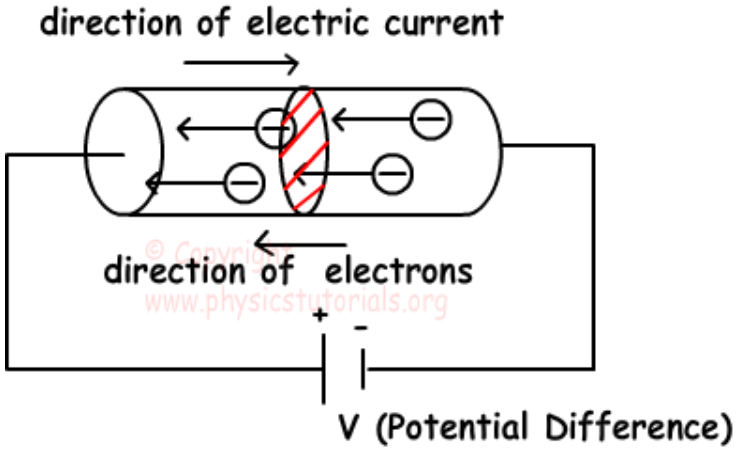
- What is the Electric Circuits?

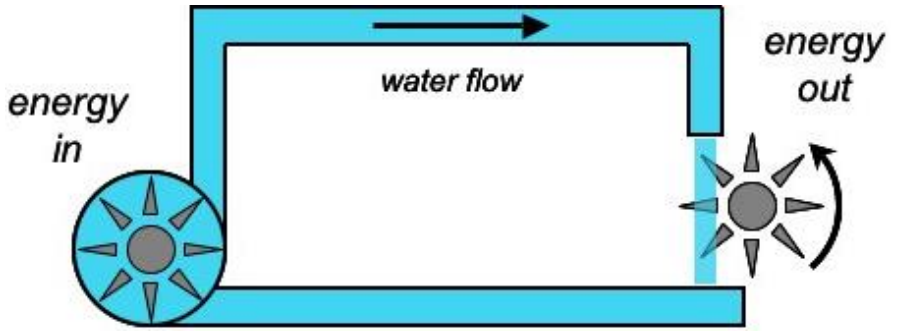
In the next following pages

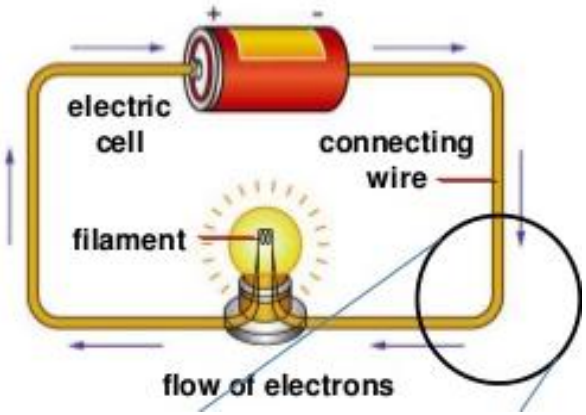
❖ ELECTRIC CURRENT

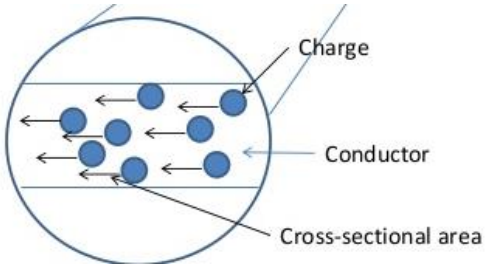
Why?

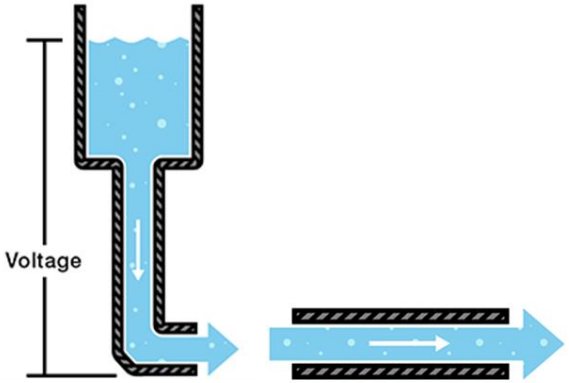
There are electron flows in the wire by the battery, as a water flow in the pipe by the water pump?









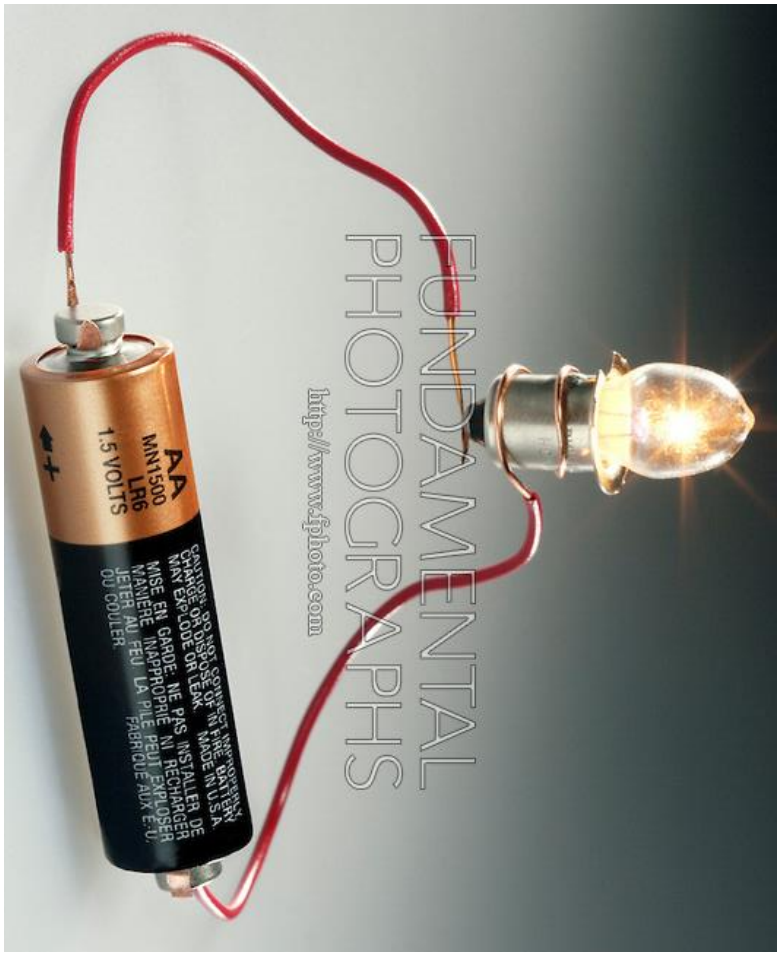


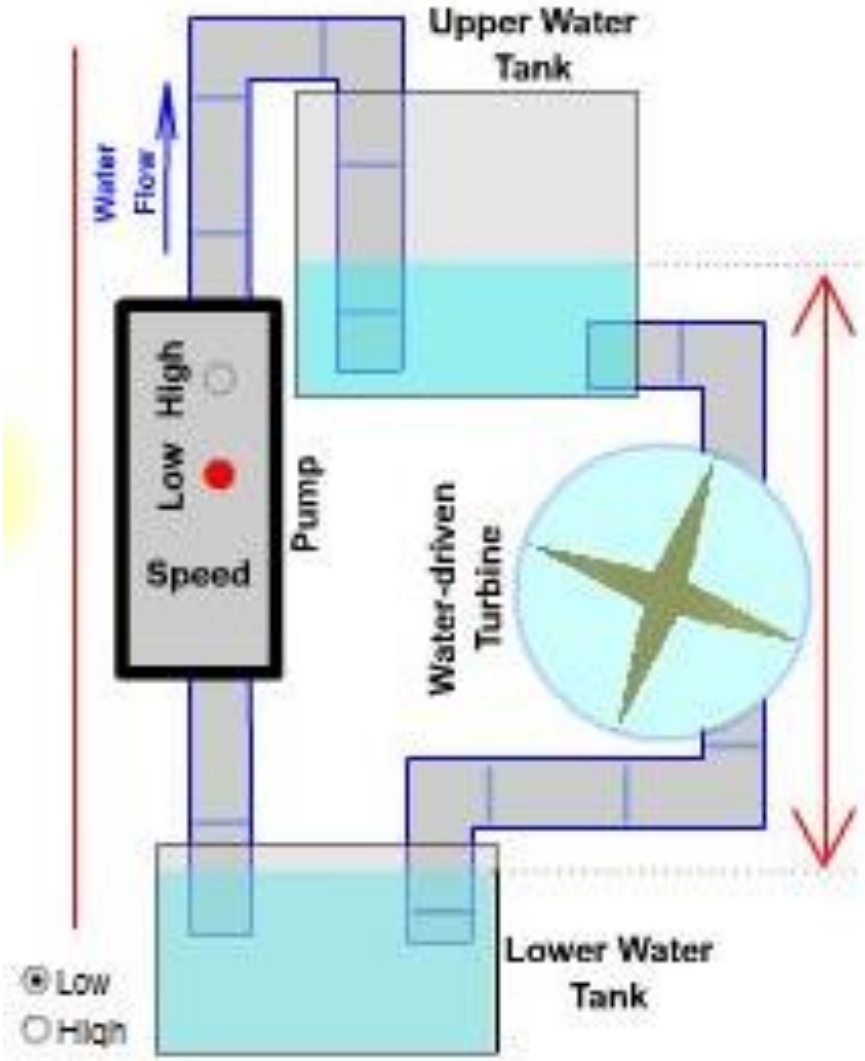
+ Where electrons, or water come from ?

❖ ELECTRIC Voltage

How the lamp on?

- **Voltage : Potential Energy Level**





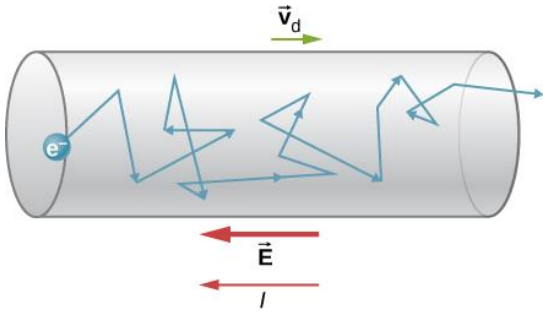
"Pumping" Charges ?

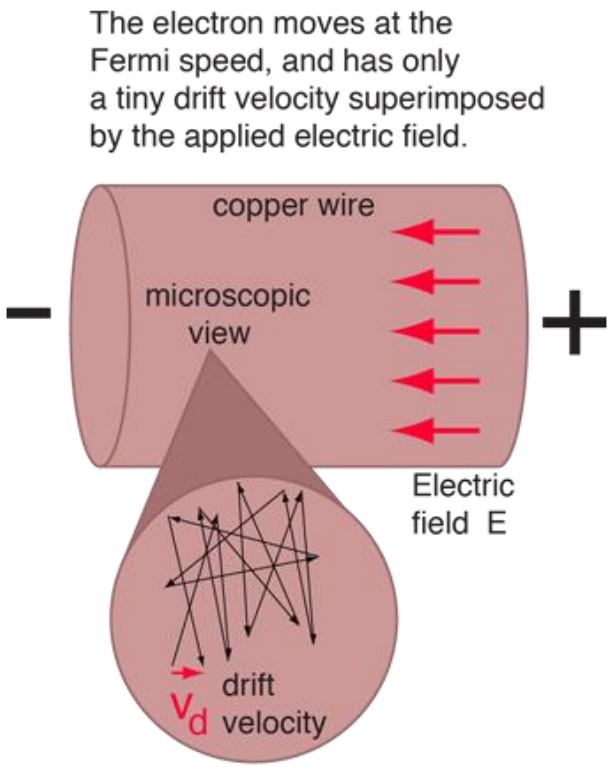
"Pumping" Water flow?

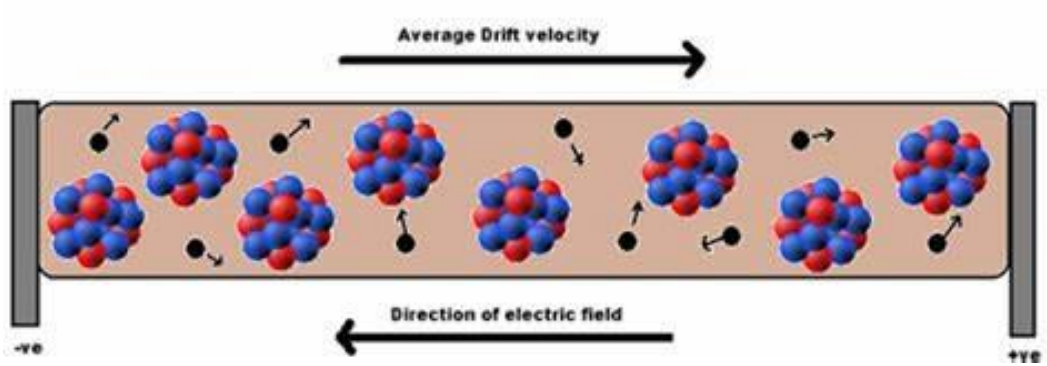
❖ Electric CURRENT (Microscopic)

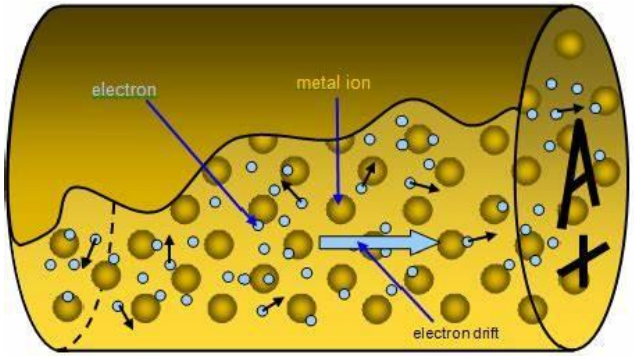
- There is the Drift velocity (v_d)

→ overall average velocity







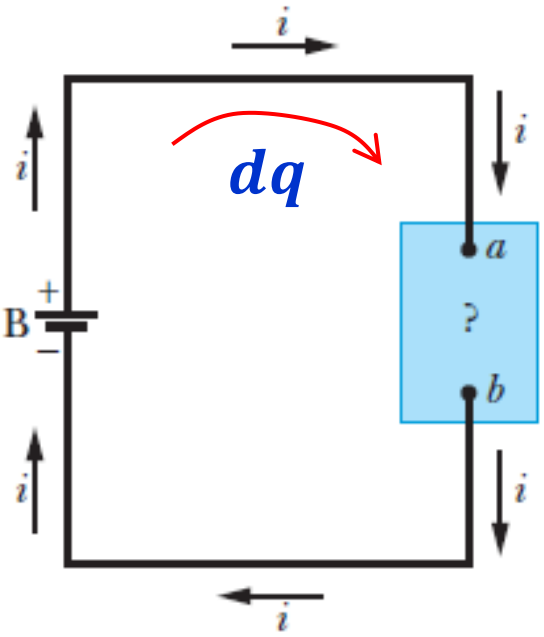


When the conductor does have a current through it, these electrons actually still move randomly, but now they tend to *drift* with a **drift speed** *vd* in the direction opposite that of the applied electric field that causes the current. The drift speed is tiny compared with the speeds in the random motion. For example, in the copper conductors of household wiring, electron drift speeds are perhaps 10^{-5} or 10^{-4} m/s, whereas the random-motion speeds are around 10^{6} m/s.

❖ Energy Conservation & Power

- **POWER:** Energy transfer per unit time

The battery at the left supplies energy to the conduction electrons that form the current.

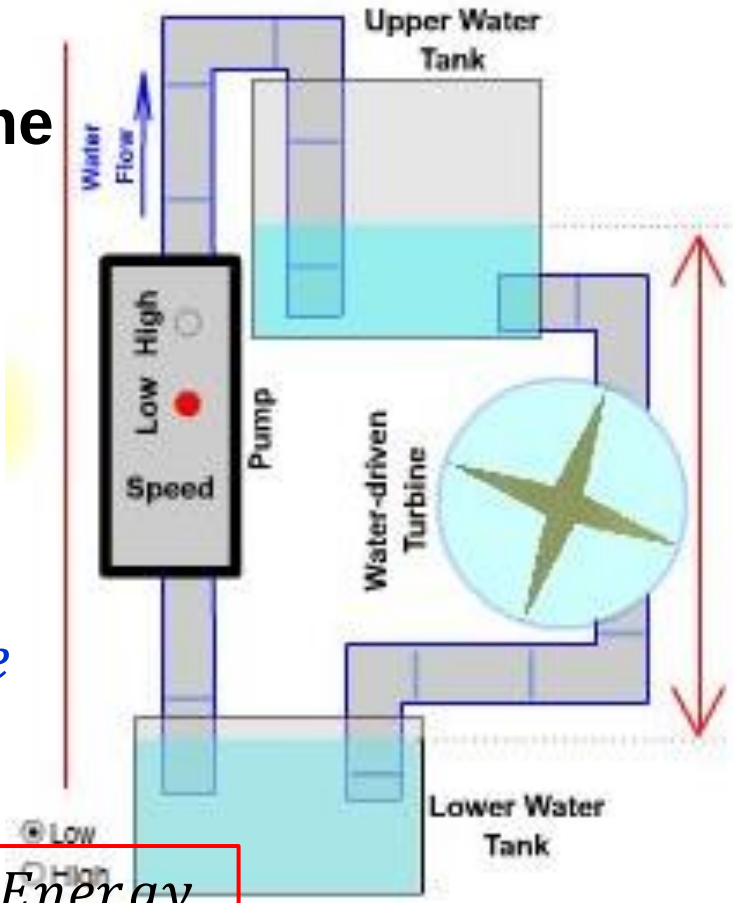


For dt,

$$dW = dU = dq\,\Delta V$$

$\Delta V = Voltage = Potential$

$dU = Potential\ Energy = dq\,\Delta V = dq\ Potential = dq\ Voltage$



$$dW = dq\,\Delta V$$

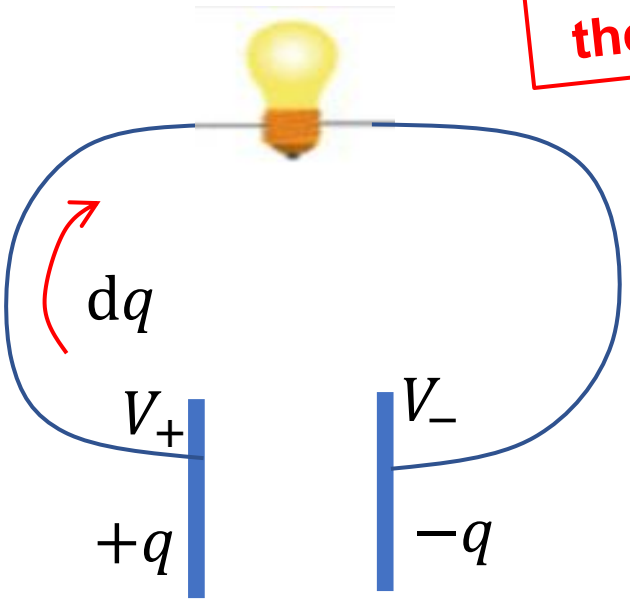
$$(dq = idt)$$

$$dW = idt\Delta V$$

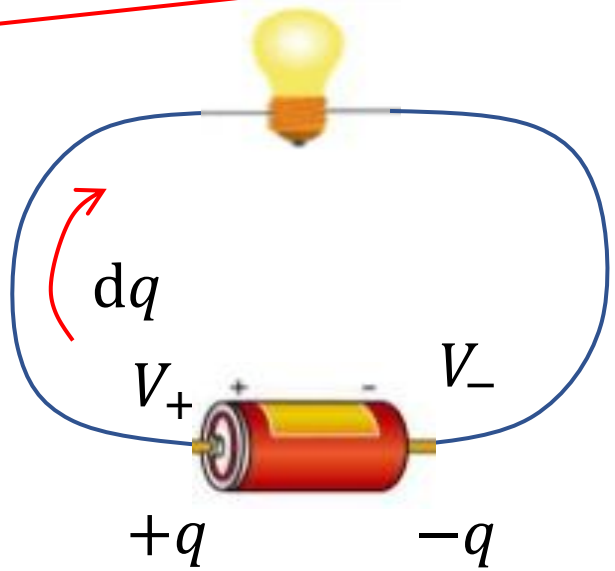
$$P = \frac{dW}{dt} = i\Delta V$$

❖ Electric force by Battery

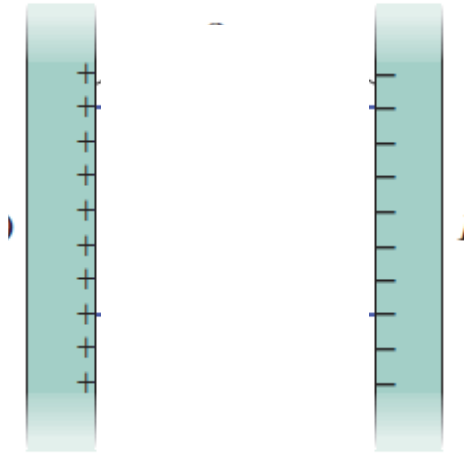
To maintain
the steady state "Current"



Capacitor

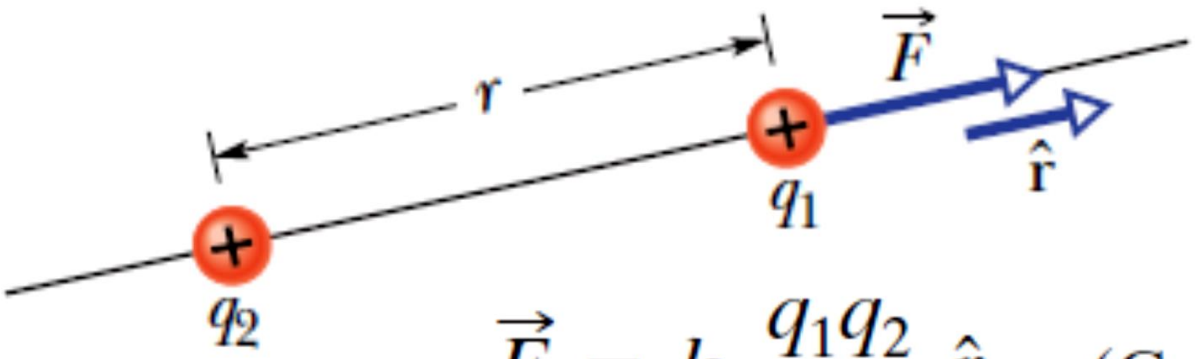


Battery



❖Electric force (Coulomb's law)

❖ Coulomb's Law for the Electric force



$$\vec{F} = k\frac{q_1 q_2}{r^2}\hat{r} \quad \text{(Coulomb's law)}$$

→ $\vec{F}_{12}$ **Electric Force on Charge of** q_1 **by Charge of** q_2

'Vector'

Magnitude

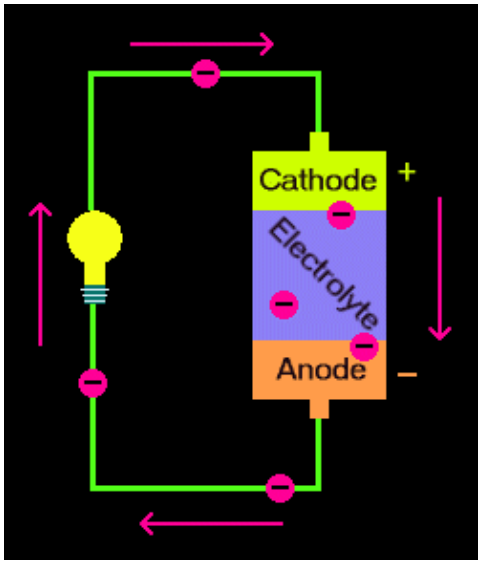
Direction

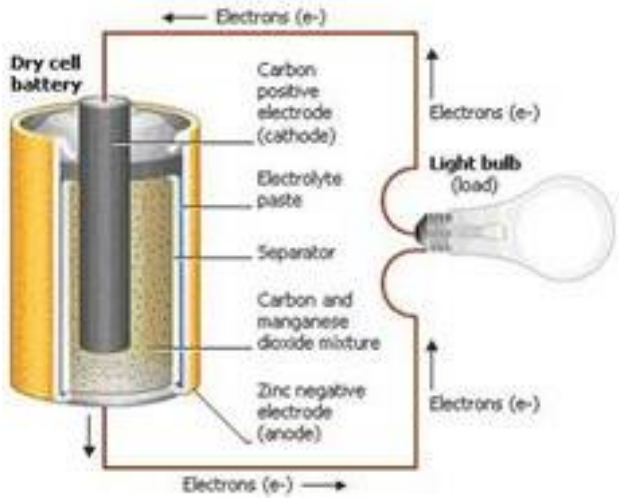
$$k = \frac{1}{4\pi\varepsilon_0} = 8.99 \times 10^9\,\mathrm{N\cdot m^2/C^2}$$ *the electrostatic constant or the Coulomb constant*

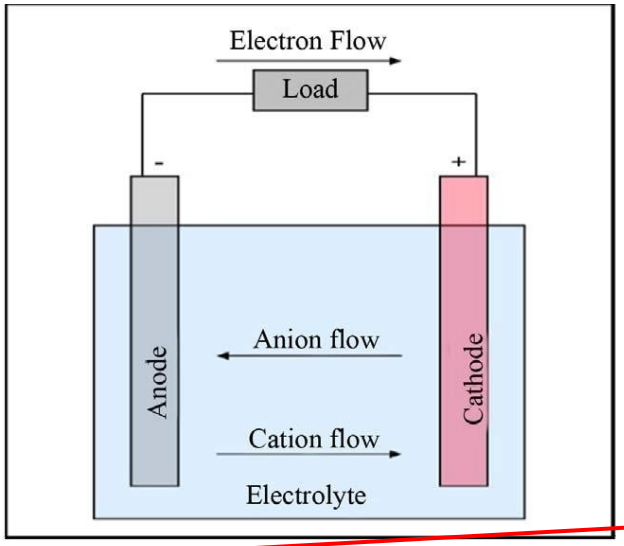
$$\varepsilon_0 = 8.85 \times 10^{-12}\,\mathrm{C^2/N\cdot m^2}$$ *permittivity constant*

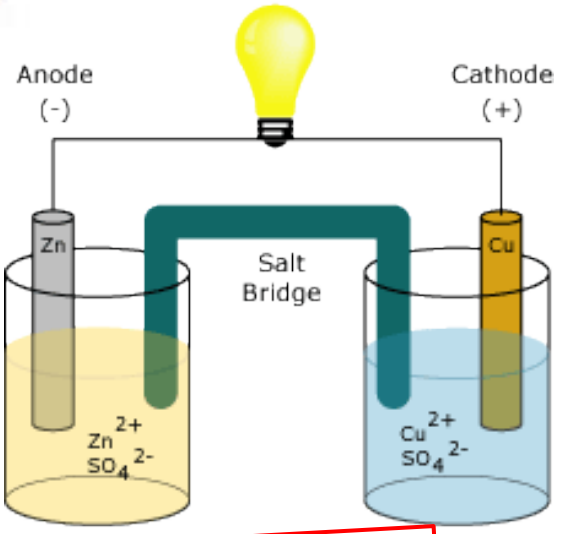
❖ Battery

→ *"Kinds of Transporting electrons across through the battery, while maintaining the voltage difference across the battery!!*







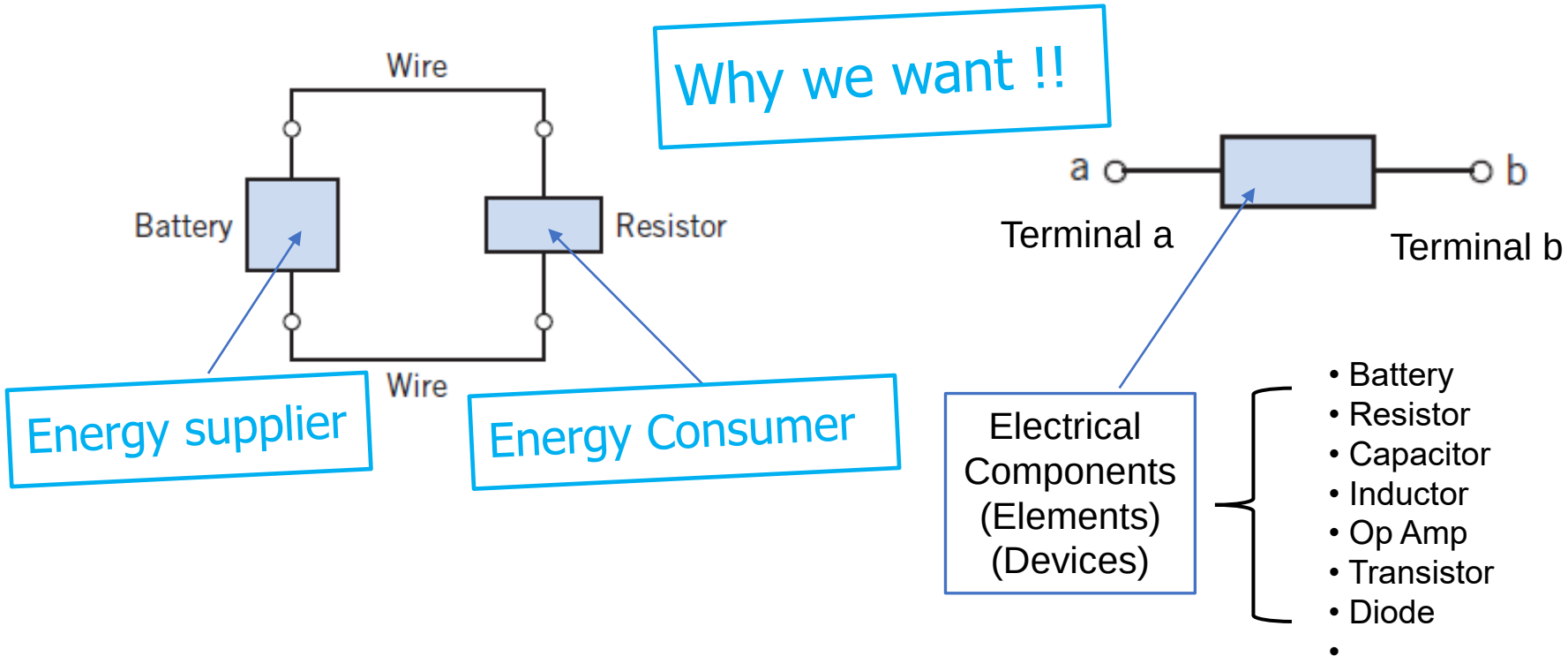


Maintain the voltage by the Chemical Reaction

❖ ELECTRIC CIRCUIT and For what?

- **What is a Electric Circuit ?**

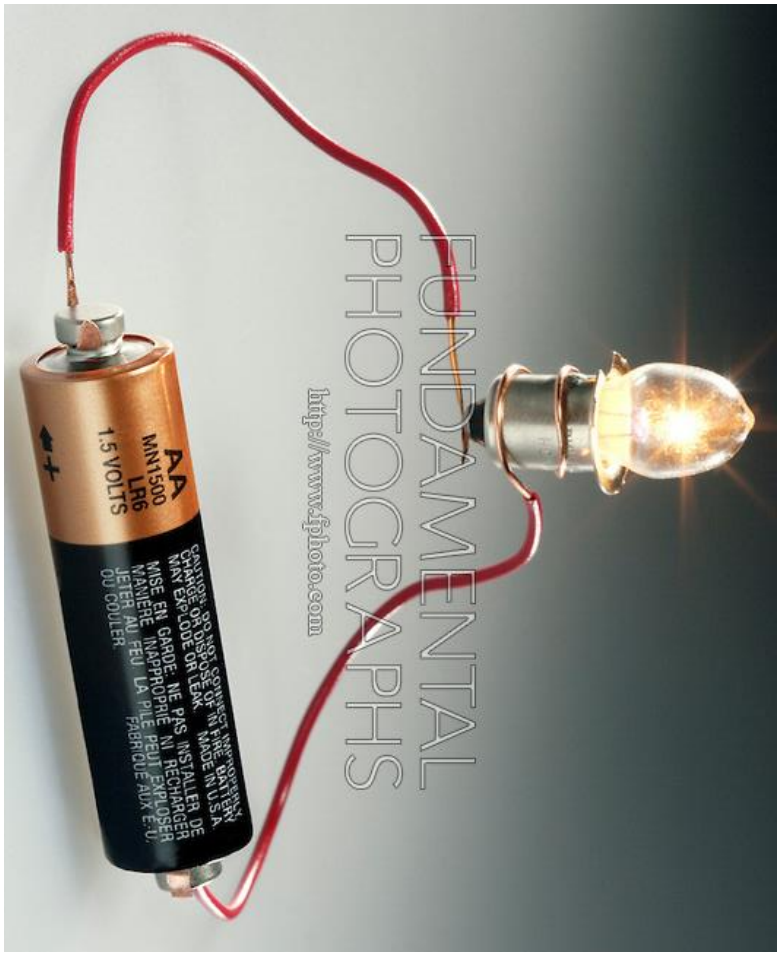
  → Connected and Closed between Electrical Components, & Current Flows



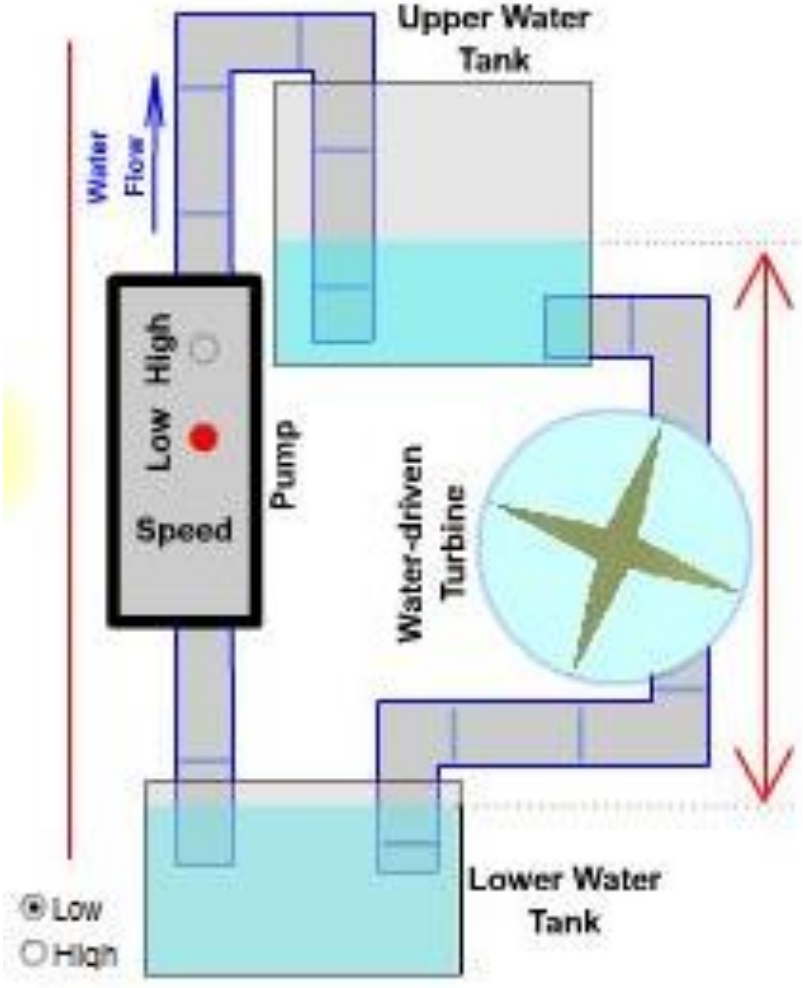
→ Basically, it is a Energy Delivery system, especially Electric Energy delivered by the Electron flows (Electric Current), so fundamentally controlled by Energy Conservation (KVL) and Charge Conservation (KCL)

❖ ELECTRIC Circuits : Energy Delivery by Current

"Electric Energy"



"Gravitational Energy"



"Pumping" Charges ?

"Pumping" Water flow?