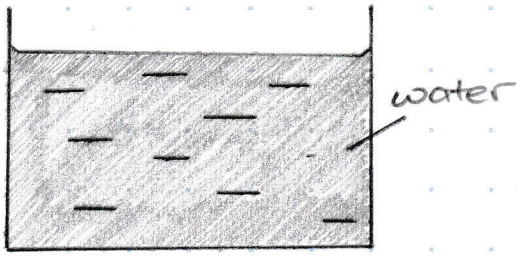
Chapter 3 : Electricity

3.1 Current and Potential Difference

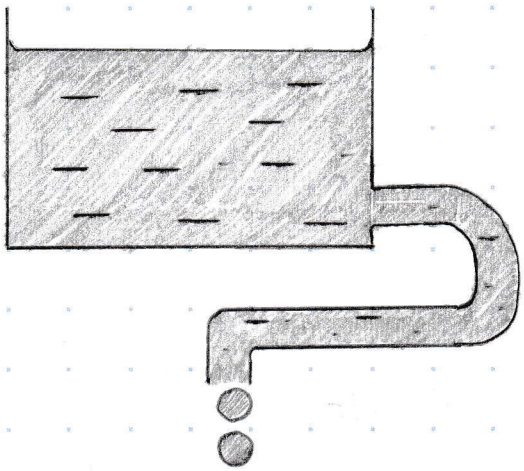
Instagram : learnwithandylim

Electricity : Think Like Water

Water Tank

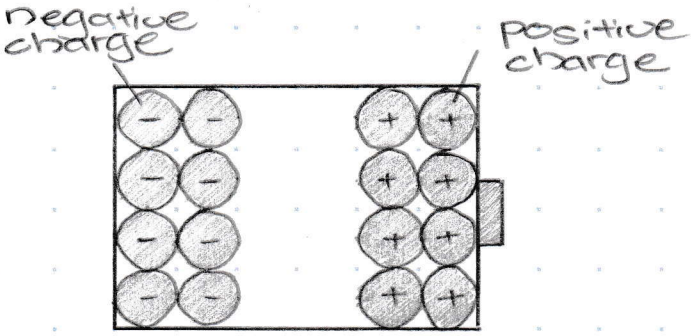


- Has a lot of **water** in the water tank
- High **pressure** water
- Has high potential energy per volume
- Strong pushing force of **water**

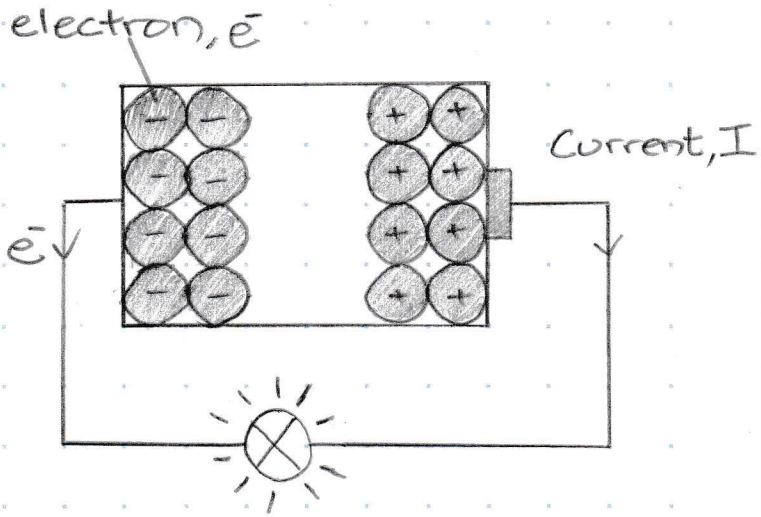


- Water flow out the tank through a **pipe**

Dry Cell / Battery



- Has a lot of **electric charges** in the dry cell
- High **voltage** battery
- Has high potential energy per unit charge
- Strong pushing force of **charge**



- Electric charge flow through a **circuit**.

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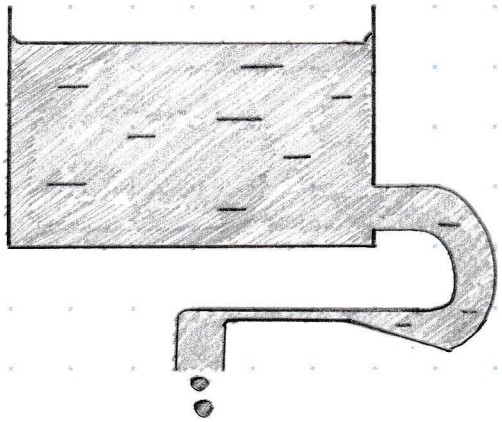
Water Tank

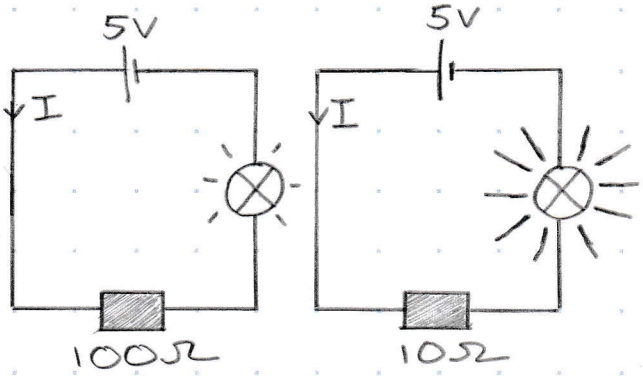
- With bigger water tank,
  - ↳ store more **water**
  - ↳ higher **pressure** (Pa)
  - ↳ greater **water** flow per unit time (L/s)



- Water difficult to flow if **narrow pipe**
- This is to slow down water
  - ↳ control water flow
  - ↳ avoid water waste
  - ↳ from flowing out too fast

Dry Cell

- With bigger battery,
  - ↳ store more **charge**
  - ↳ higher **voltage** (V)
  - ↳ greater **charge** flow per unit time (C/s)
  - ↳ greater **current** (A)



$V = IR$

$I = \frac{5}{100}$

$I = 0.05A$

$V = IR$

$I = \frac{5}{10}$

$I = 0.5\ A$

- Difficult for charge to flow if **high resistance** (Ω)
  - ↳ control **current** flow
  - ↳ protect appliances
  - ↳ from overheat damage

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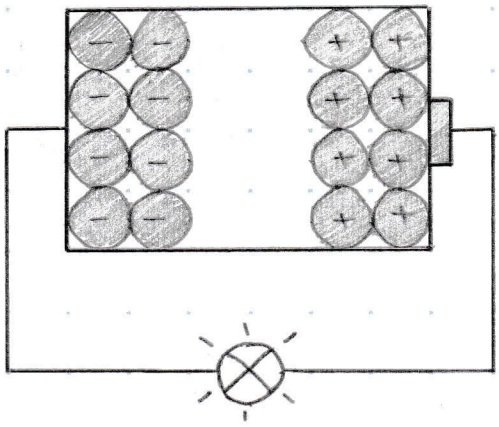
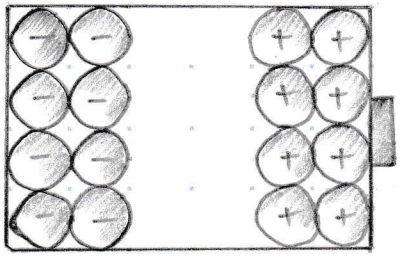
Potential Difference , V



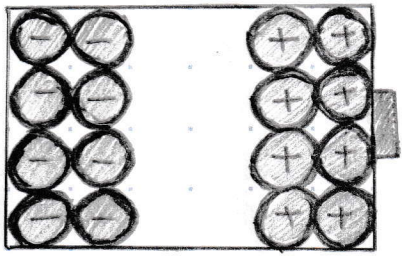
- Positive charge exists at positive terminal.
- Negative charge exists at negative terminal.
- Like charge repels , opposite charge attracts.
  - ↳ opposite charge move to opposite side
  - ↳ movement of charge = electric current
  - ↳ there is current (move. of charge) in wire.
- Scenario : I have 2 dry cells. Which one can push the charges more strongly?

5V



- charges flow out with lower potential (slow flow)
- less energy per charge
- $5V = 5\ \frac{J}{C}$

10V



- charges flow out with higher potential (rush / shoot out)
- more energy per charge
- $10V = 10\ \frac{J}{C}$

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Potential Difference, V (aka voltage)

- is the energy transferred
- in moving one coulomb of charge
- from one point to another.

- loosely speaking :
  ↳ How much energy each charge carry out from the dry cell.

$$V = \frac{W}{Q} \quad \text{OR} \quad V = \frac{E}{Q}$$

where
- V = potential difference (V)
- W = work done (J)
- E = energy transferred (J)
- Q = amount charge flow (C)

- symbol for p.d. : V
- unit for p.d. : Volt (V)
  : $\frac{\text{Joule}}{\text{Coulomb}}$ $\left(\frac{J}{C}\right)$

} S.I.