Electric Potential Energy

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Electric Potential Difference

We can define and electric which does not depend on charge by using a “ “

charge

Change in potential is change in potential energy for a test charge divided by the unit charge

Remember that for uniform field

E. Potential & Potential Energy vs Electric Field & Coulomb Force

Electric Potential, units

capacitor: stores electrical energy by virtue of separated charges

conductors

insulator

capacitance: a measure of capacitor’s ability to store

charge/energy

Depends on: 1.

2.

values of dielectric constant  vacuum…1.00000

air………. 1.00059

water…….80

One equation for capacitance:

C = capacitance (F) o = 8.85 x 10-12 C2/N.m2

A = area of one plate (m2) d = plate separation (m)

Capacitance can be measured another way. A potential difference V applied to the plates causes:

**one plate to get a charge of +Q** and **the other to get a charge of –Q**

*Circuit A*

*Circuit B*

Second equation for capacitance:

Capacitor of capacitance 5.5 F is connected to a potential difference of 18 V. How many e– will move from one plate to the other?

Capacitor w/rubber as dielectric ( = 4.8) has plate area 2.0 cm2 and plate separation 1.0 mm. For a 9.0 V potential difference, how much charge will each plate store?

Because it takes work to separate electric charges, capacitors store…

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Find energy stored when a 0.33 F capacitor is connected across a 120 V potential difference.

**Electric Current and Circuits**

current: the rate of charge flow (NOT the speed of charge flow)

|  |  |  |
| --- | --- | --- |
| **Amount of**  **Charge Flow** | **Time of Flow** | **Rate of**  **Charge Flow** |
| 100 charges | 2 s |  |
| 500 charges | 25 s |  |

One equation for current:

5.8 C of charge flow through a bulb filament in 3.1 s. Find current flowing through filament.

How many e– flow through bulb in one hour?

If 1.0 mole of e– flow through an appliance in 5.6 hours, find current pulled by appliance.

**Ohm’s Law**

Voltage is an electric…

R

L

L

L

Equation for Ohm’s law: R = resistance, in ohms ()

V

I

I

V



ohmic resistor non-ohmic resistor

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Hair dryer w/resistance 280  is plugged into a standard outlet. What current flows through hair dryer?

Suppose hair dryer is plugged into an outlet with potential difference 220 V. Find current.

**Electric Power** Equation**:**

P = power rating / power consumed (W)

A microwave has power rating 1.0 x 103 W. What current flows through it?

A refrigerator “pulls” 6.25 A. What is its power rating?

What is the resistance of a 75 W light bulb?

For a 100 W bulb…

**Cost of Electricity** Equation:

A computer “pulls” 4.0 A and runs constantly. Electricity costs $0.08/kWh. Find cost to run computer for one year.