PHYSICS EVIDENCE 3:
NOTE-TAKING FROM DIFFERENT RESOURCES

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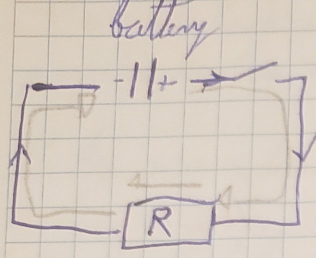
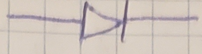
IB ATTRIBUTE: BALANCED

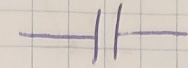
Notetaking from class

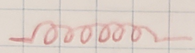
Electric Circuits

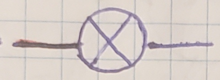
Electric current = flow of electric charge.

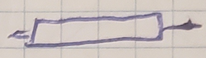


diode  only allow electric current to flow in one direction

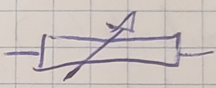
Capacitor  stores electrons

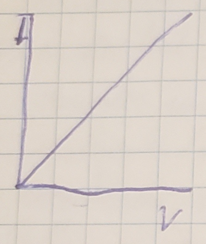
(R)  coil / inductance / choke

lamp 

resistor 

something which consumes energy

variable resistor 



provided that the system conserves energy, Ohm's law states that $V \propto I$.

Resistance is the Gradient of the slope.

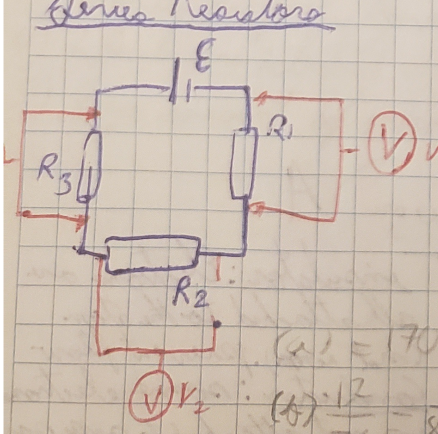
So $V = KI$ (K = constant) R is VA^{-1} = Ohm (Ω)

$V = RI$

→ 1V = 1 Joule of energy per coulomb of electrons

Series Resistors

26/11/2019



find out total Resistance

(sum of) $\sum R_1 + R_2 + R_3 + \ldots$

Current flowing

→ Ohm's law: $IR = V$ = $I = \frac{V_E}{R_T}$

(a) = 170 Ω

(b) $\frac{12}{170} = \frac{6}{85}$ A

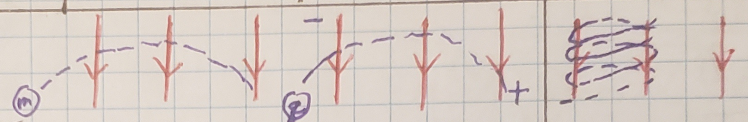
(c) $V_1 = \frac{24}{17}$, $V_2 = \frac{120}{17}$, $V_3 = \frac{60}{17}$ V $= \frac{204}{17} = 12V$

Notetaking from Kognity

Charge is a property of elementary particles. two charged objects produce an electrical force that depends on the product of their charges and (like gravity!) the force diminishes as a function of the inverse square of their separation i.e. $F \propto \frac{1}{r^2}$

Charge: lack or surplus of electrons

	Gravitational	Electric	Magnetic
fundamental quantity	mass	charge	moving charge
units	N/kg	N/C	N/C·m/s (tesla)
force & field direct°	same	⊕ same ⊖ opposite	force is perpendicular to $\vec{v}$ and forcefield $\vec{B}$
Path in uniform field	parabolic	parabolic	Helical
way to obtain uniform fields	Earth's surface	parallel plates	solenoids

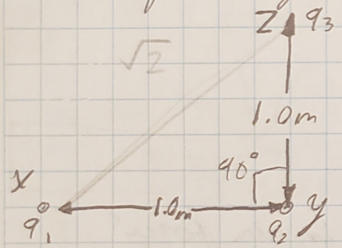


Coulomb's law
force of attraction or repulsion btwn 2 point charges

→ $F = k\frac{q_1 q_2}{r^2}$

r must be much bigger than the size of the charges in order to apply Coulomb's law

Three equal charges X, Y, and Z are fixed in the positions shown.



the electric force btwn X and Y is F. The Electric force btwn X and Z is...

$F_{xy} = \frac{k\, q \cdot q}{r^2}$ (equal charges)

$F_{xz} = \frac{k q^2}{\sqrt{2}^2} \rightarrow F_{xz} = \frac{1}{2} F_{xy} = \frac{F}{2}$

the electric field surrounding a Point charge

test charge: a charge that doesn't create a significant electric field of its own.

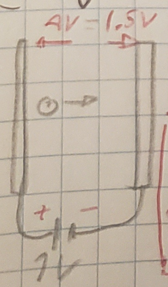
Electric Potential difference

J/C = Volt → EPE = Voltage

gravity
$W = \Delta GPE$ | ΔE_p in booklet
$= mgh, = m\Delta V$
$=$ kg ·   J/kg
$=$ J

charge (electric)
$W = \Delta EPE$
$= q\,\Delta V$ charge
("Gravitational potential difference") $=$ C · J/C
$=$ J

EPD = Voltage
units: J/C = volt
- energy per unit charge
- spatial
- $W = q\,\Delta V$



$\Delta KE = qV$
$= (1.6 \times 10^{-19}\,C) \cdot 1\,J/C$

Electron volt (eV) is the amount of energy gained by one elementary charge when accelerated across 1 volt

Notetaking from YouTube course

Voltage & current

Electric current is a measure of flow of charge. Units: Amperes (A), symbol I. 1A = 1C of charge is passing a point every second i.e. A = C/s

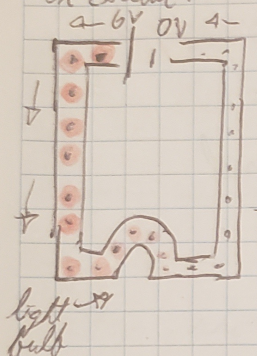
voltage causes electrical current → voltage is like "electrical pressure" in a pipe.

| Voltage = Electric potential |

Volts
J/C

at a position of ↑ Voltage charges have more Energy and will be pushed towards position of ↓ energy

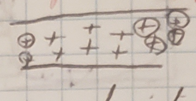
in circuit:



left: there is J/C i.e. energy for energy/C of flow

right: after bulb, current is the same but no J per C

Electron drift



$I = nAvq$

current

n: chg. carrier density # of conduct° of electrons per unit volume (m^3)

A: cross sectional area of wiring

v: drift speed

q: charge (chg.) per charge carrier (e.g. charge of an electron) $1.6 \cdot 10^{-19}$ C

$T = \frac{d}{v}$ — d: length of wire, v: drift velocity

Exercise: guage 12 copper wire btwn car battery & headlights is 2.0m long. What would be the average time for an individual electron to drift from battery to headlight w/ given current of 3.0A, and wire d = 1.0m m.

given info: guage 12 = 3.30 mm² (3.3 mm²)

• free electron concentrat° of copper: 8.5×10^{28} (m^{-3}) at (300K)

q = elementary charge … 1.6×10^{-19} C

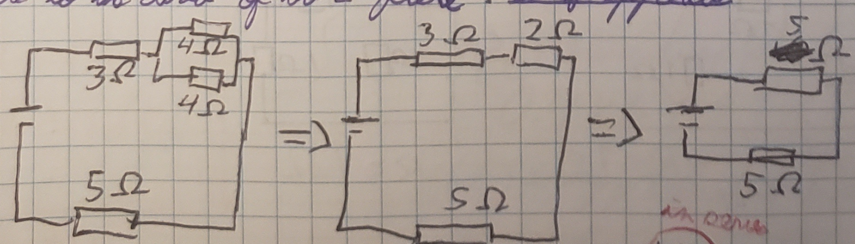
$T = \frac{d}{v}$ $v = \frac{I}{nAq}$

$= \frac{3.0\,A}{(8.5 \times 10^{28})(3.3 \times 10^{-6})(1.6 \times 10^{-19} C)} = 6.7 \cdot 10^{-5}$ m/s

$T = \frac{2.0\,m}{6.7 \times 10^{-5}\,m/s} = 29900\,s = 8.3$ hours

Conduction/free electrons execute a complex motion that shows an overall migrat° opposite to the direct° of the E-field. drift opposite

e.g.



$\frac{1}{4} + \frac{1}{4} = 2$

R_{total} = 2.5Ω

(more on the back)

②