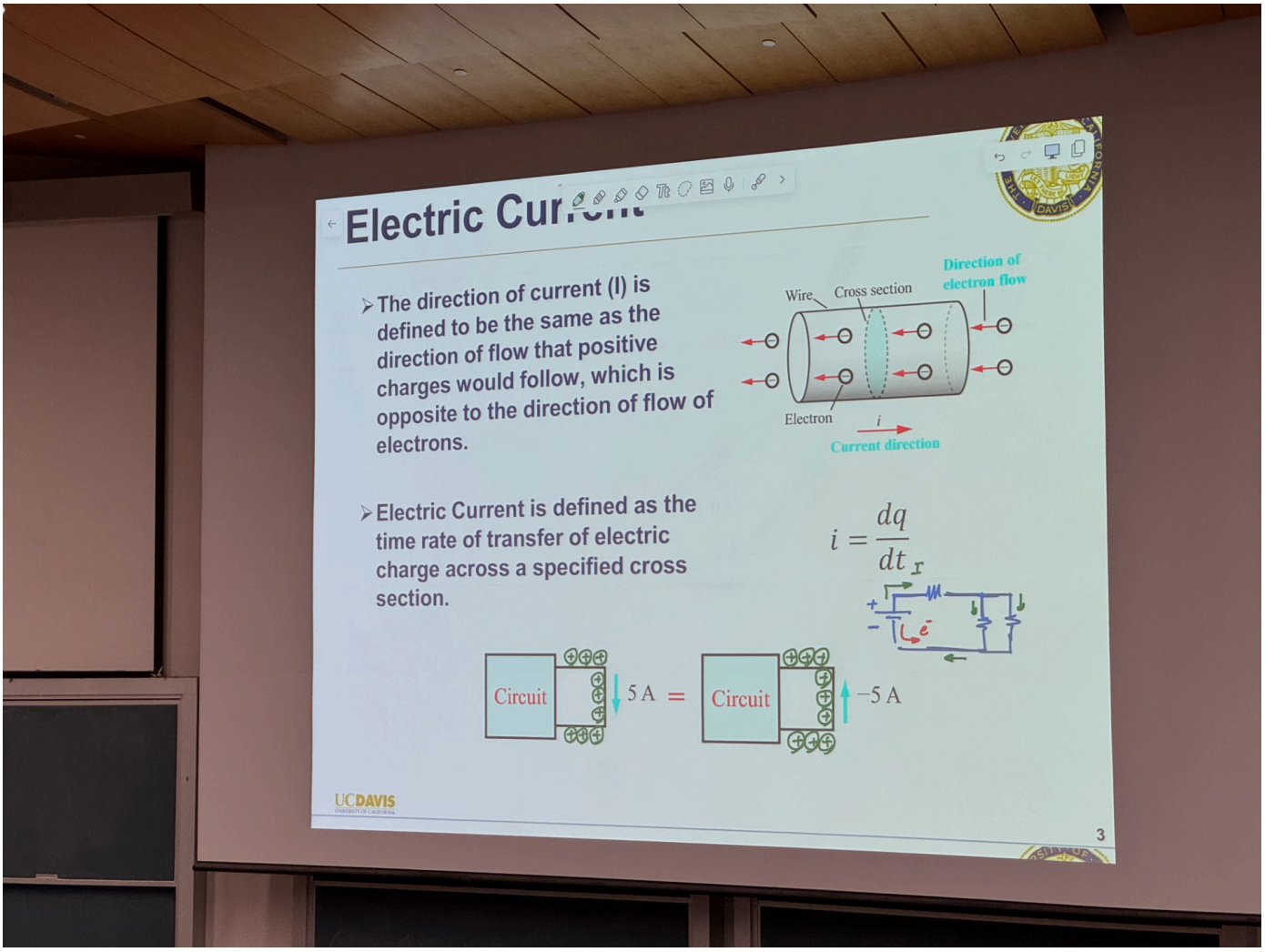
Lecture 2


Electric Cur
The direction of current (I) is defined to be the same as the direction of flow that positive charges would follow, which is opposite to the direction of flow of electrons.
Wire
Cross section
Direction of electron flow
Electron
i
Current direction
Electric Current is defined as the time rate of transfer of electric charge across a specified cross section.
$i = \frac{dq}{dt}$
Circuit
5 A
=
Circuit
−5 A
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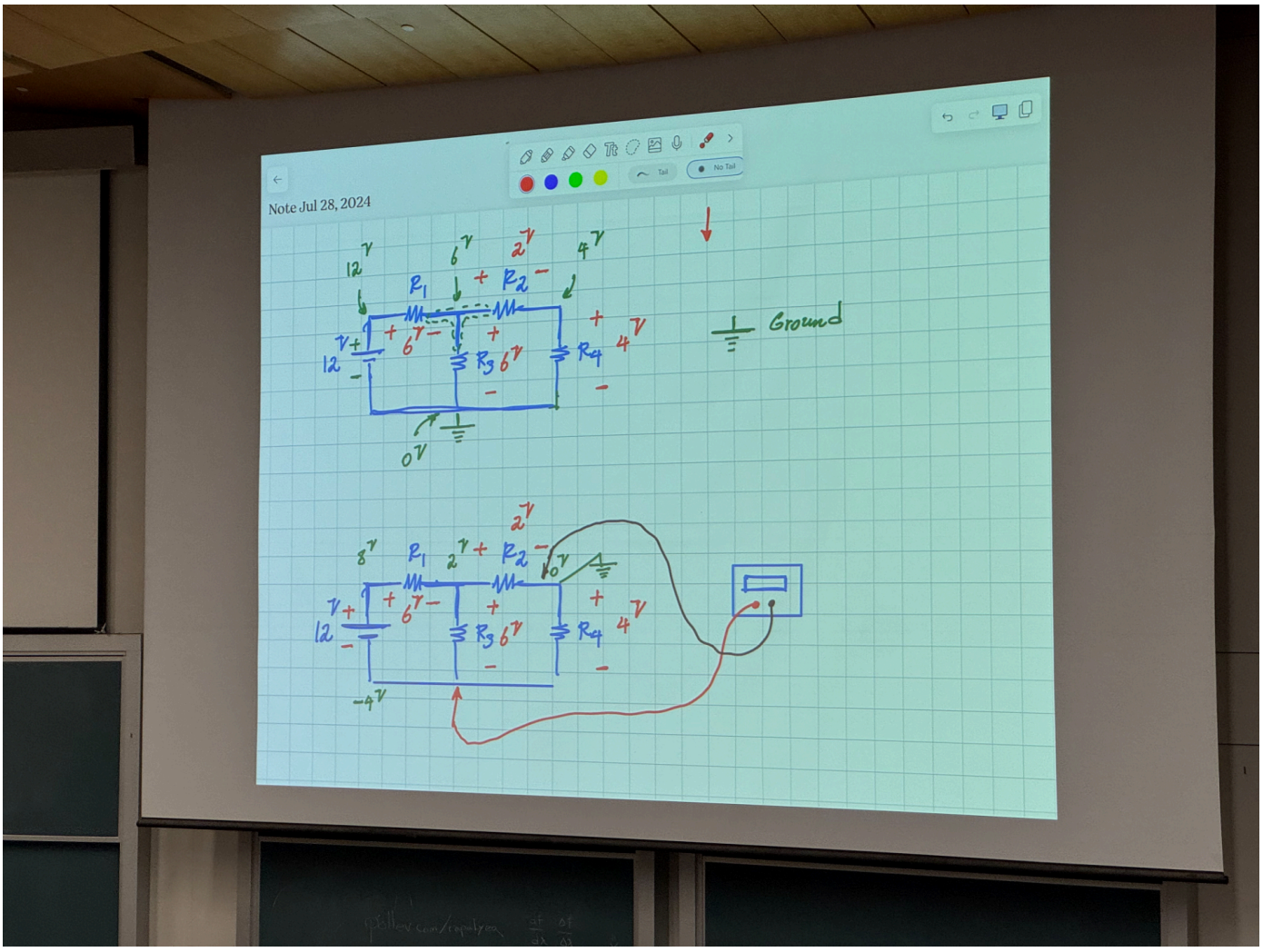
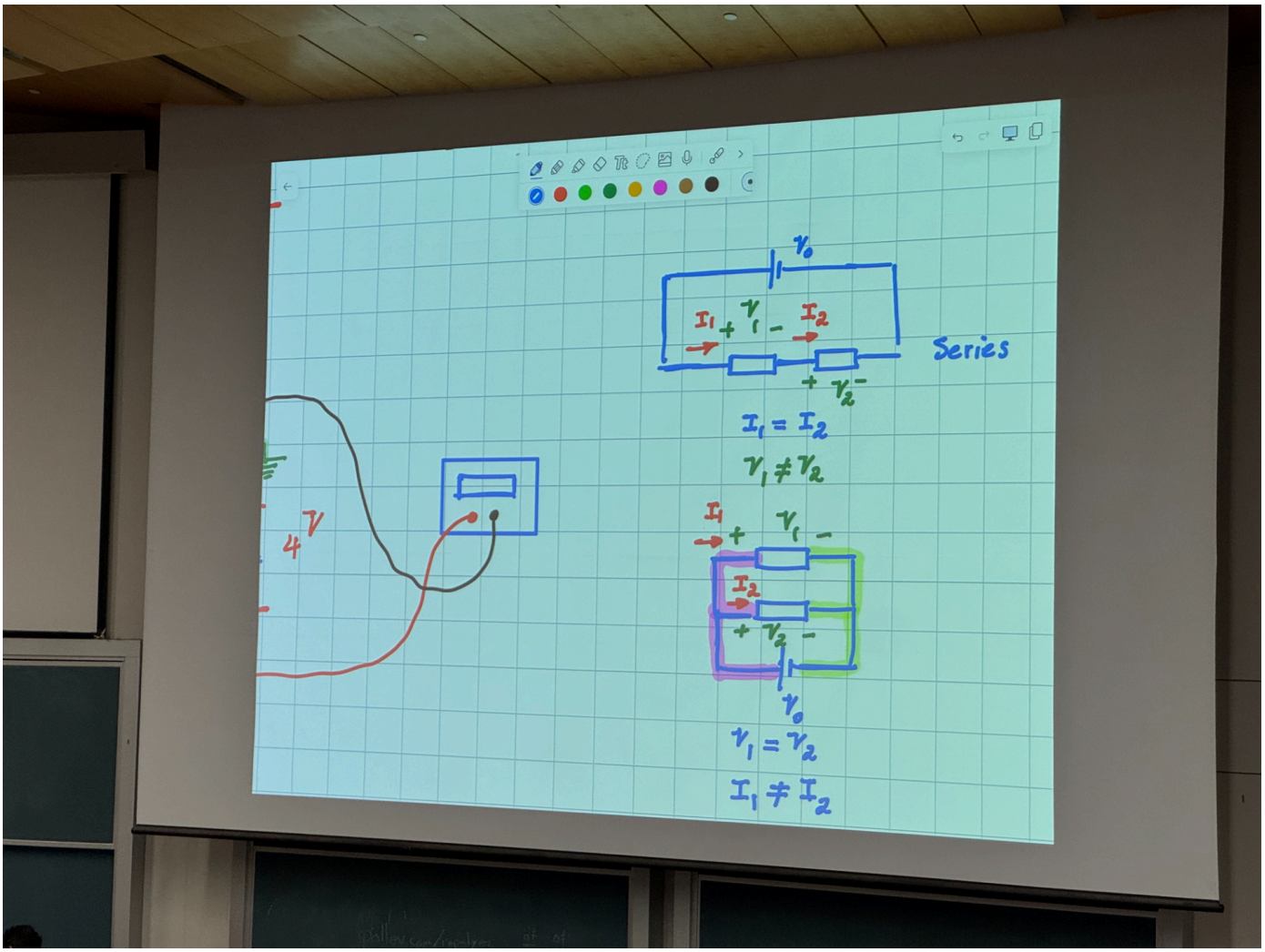
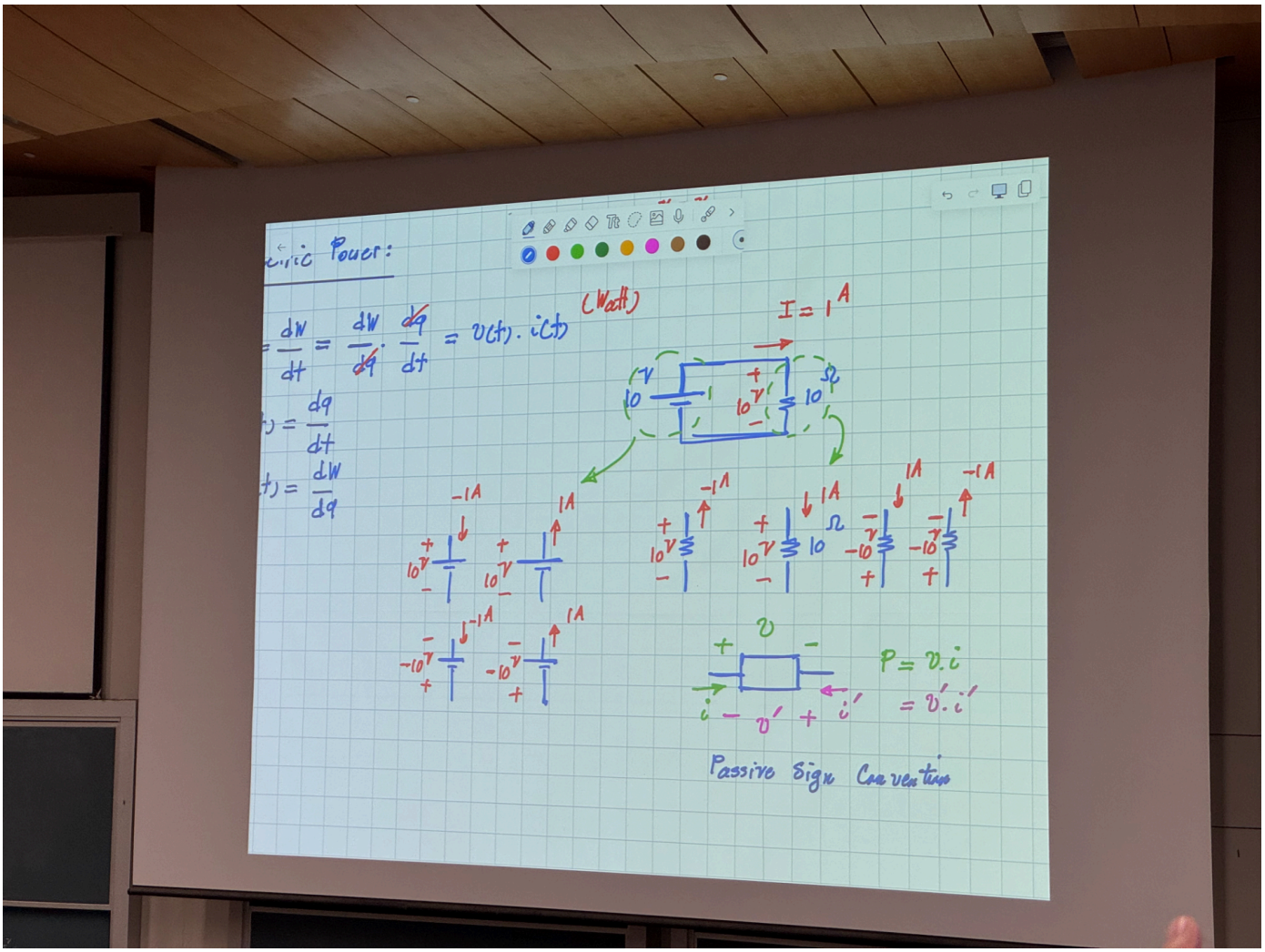
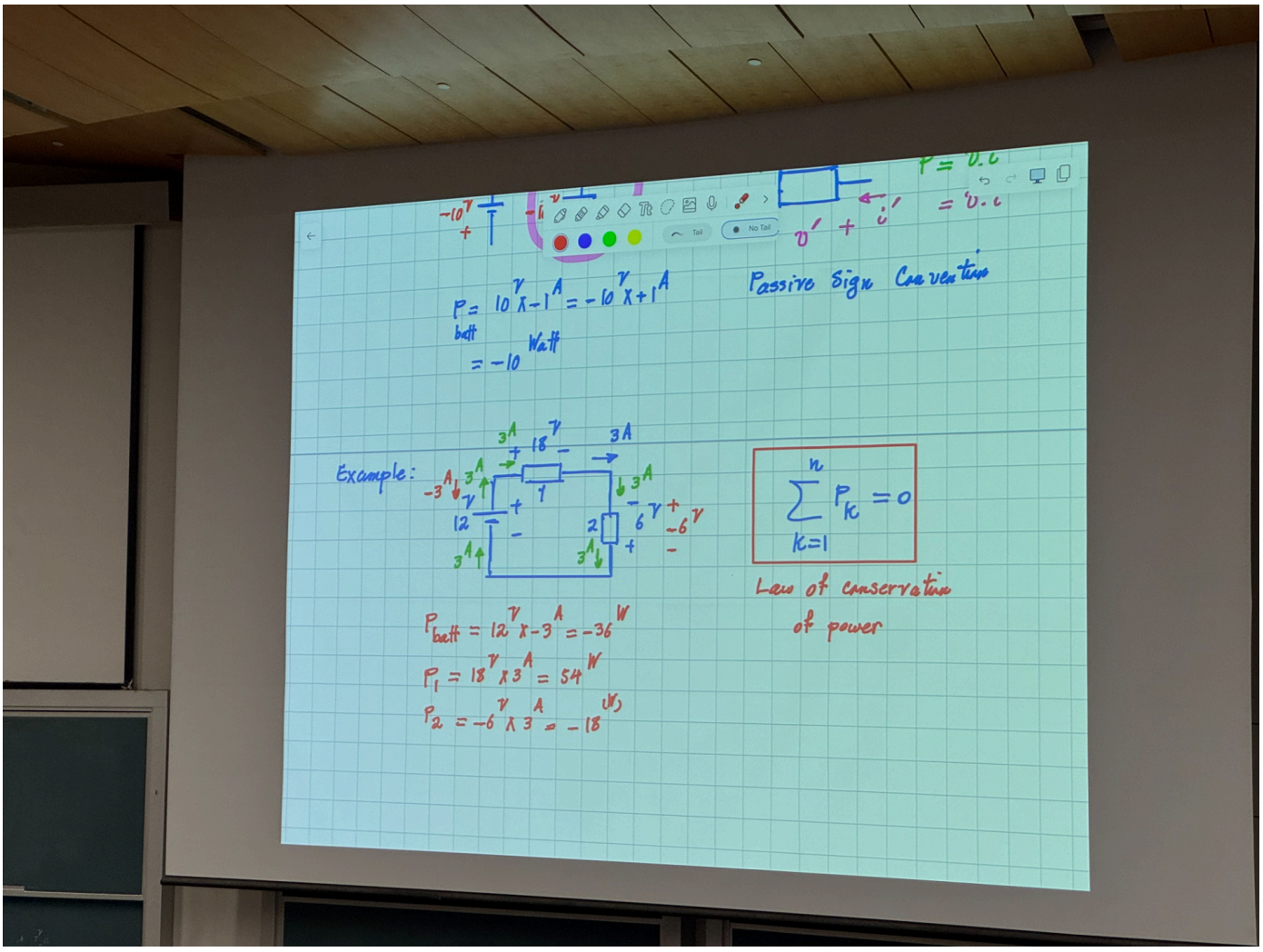
3


Note Jul 28, 2024
12V
6V
2V
4V
R1
R2
R3
R4
Ground
0V
8V
-4V


V_0
I_1
V_1
I_2
Series
V_2
$I_1 = I_2$
$V_1 \neq V_2$
I_1
V_1
I_2
V_2
V_0
$V_1 = V_2$
$I_1 \neq I_2$
4 V

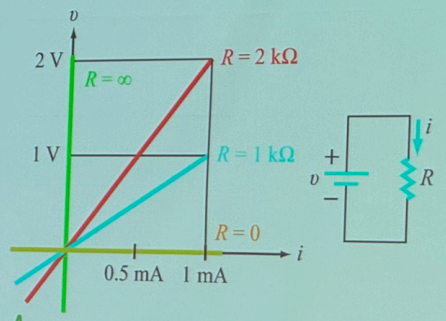

Power:
$\frac{dW}{dt} = \frac{dW}{dq} \cdot \frac{dq}{dt} = v(t) \cdot i(t)$
(Watt)
$i(t) = \frac{dq}{dt}$
$v(t) = \frac{dW}{dq}$
I = 1 A
10 V
10 Ω
-1A
1A
$P = v \cdot i$
$= v' \cdot i'$
Passive Sign Convention

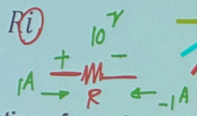

-10 V
+
-1 A
P = 10 V x -1 A = -10 V x +1 A
batt
= -10 Watt
Passive Sign Convention
P = v.i
= v.i
v
+
i
Example:
3A
18 V
3A
-3 A
3A
1
3A
12 V
+
-
2
6 V
+
-6 V
-
3A
3A
P batt = 12 V x -3 A = -36 W
P1 = 18 V x 3 A = 54 W
P2 = -6 V x 3 A = -18 W
Law of conservation of power

$i - v$ Characteristics of Ideal Resistor

- Ohm's law: the voltage across a resistor (v) is directly proportional to the current (i) flowing through it:

$$v = Ri$$





- The power rating of a resistor defines the maximum continuous power level that the resistor can dissipate without getting damaged. Excessive heat can cause melting, smoke, and even fire.

$$p = vi = Ri^2 = \frac{v^2}{R}$$

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13

Kirchhoff's Current Law (KCL)