S4

SMALL SATELLITES FOR SECONDARY STUDENTS

Introduction to Electronics

Prof. Lynn Cominsky

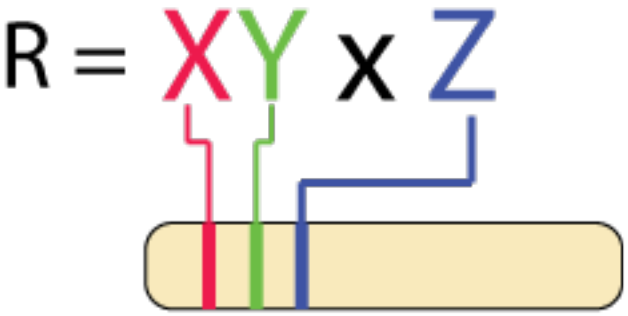
Ohm's Law

- Summarizes the relationship between Potential Difference (V), resistance (R) and current (I)
- Potential difference is measured in volts (V)
- Resistance is measured in ohms (Ω)
- Current is measured in amperes (A)

$$V = IR$$

Resistor Color Code

Color	Band 1	Band 2	Band 3
Black	0	0	1.00
Brown	1	1	10.00
Red	2	2	100.00
Orange	3	3	1,000.00
Yellow	4	4	10,000.00
Green	5	5	100,000.00
Blue	6	6	1,000,000.00
Violet	7	7	10,000,000.00
Grey	8	8	
White	9	9	
Gold			0.10
Silver			0.01

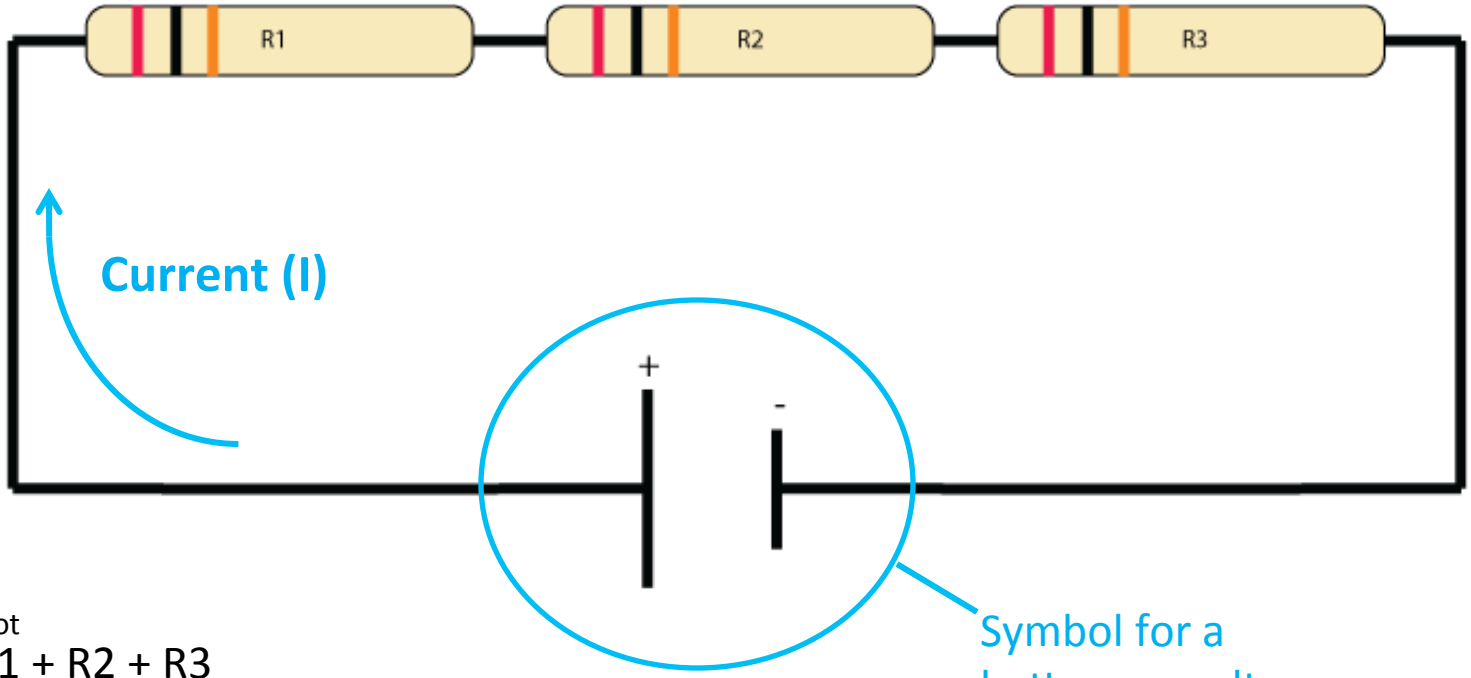


What is this resistance?

Brown→ 1
Green→ 5
Brown → x 10
=150 Ω

Series Resistors

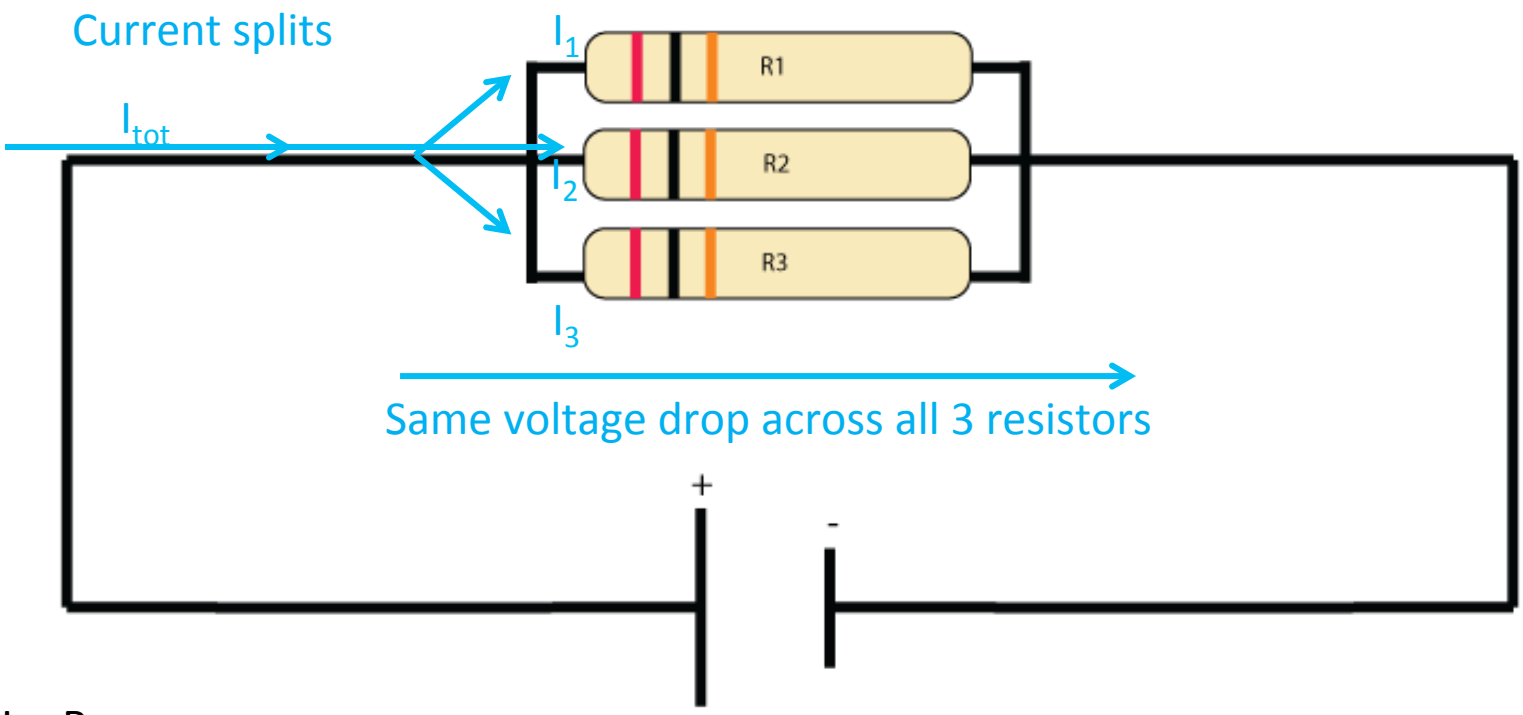
Same current flows through all 3 resistors



$V = I R_{tot}$

$R_{tot} = R1 + R2 + R3$

Parallel resistors



$V = I_{tot} R_{eq}$

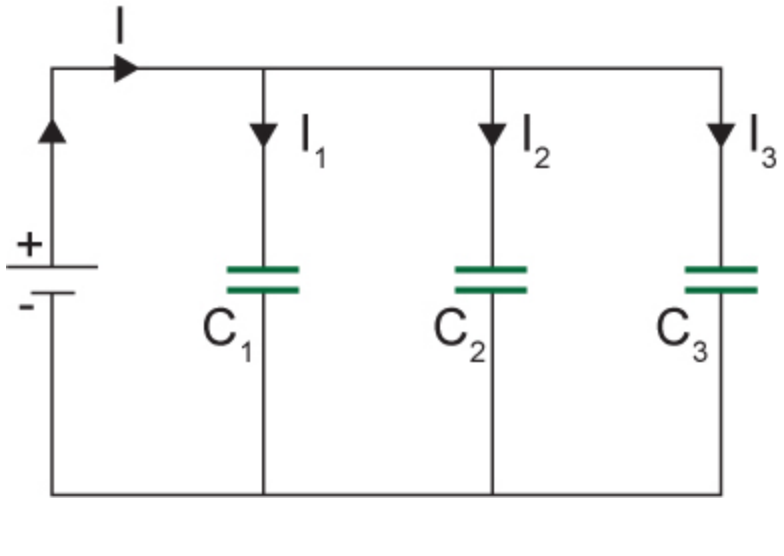
$V = I_1 R_1 = I_2 R_2 = I_3 R_3$

$I_{tot} = I_1 + I_2 + I_3$

$1/R_{eq} = 1/R1 + 1/R2 + 1/R3$

Capacitors in Parallel

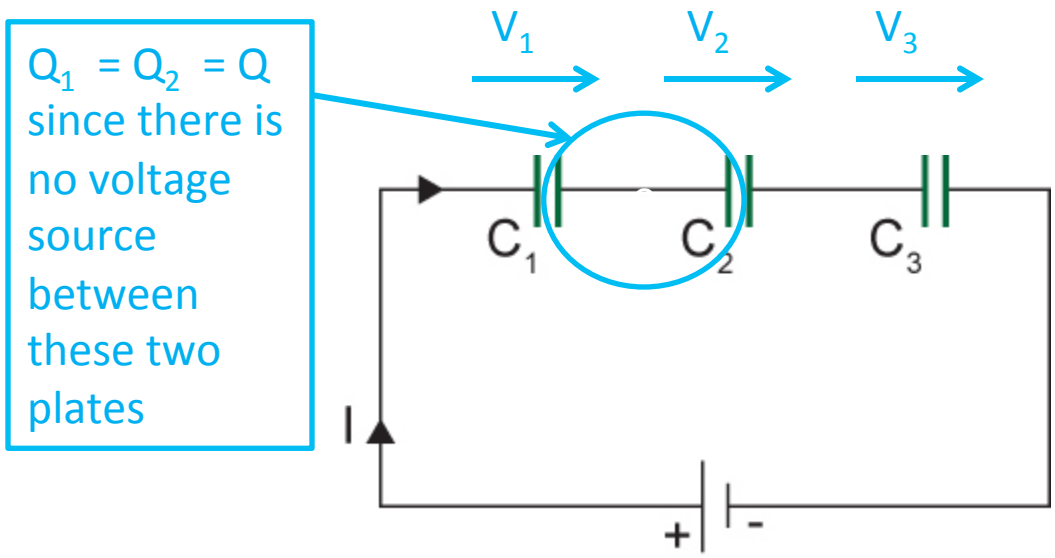
definition of capacitance:
C = Q/V where Q is the charge held on a plate



Same voltage drop across all 3 capacitors

$V = Q_{tot} / C_{tot}$
$V = Q_1/C_1 = Q_2/C_2 = Q_3 /C_3$
$C_{tot} = Q_1/V + Q_2/V + Q_3/V$
$C_{tot} = C_1 + C_2 + C_3$

Capacitors in series



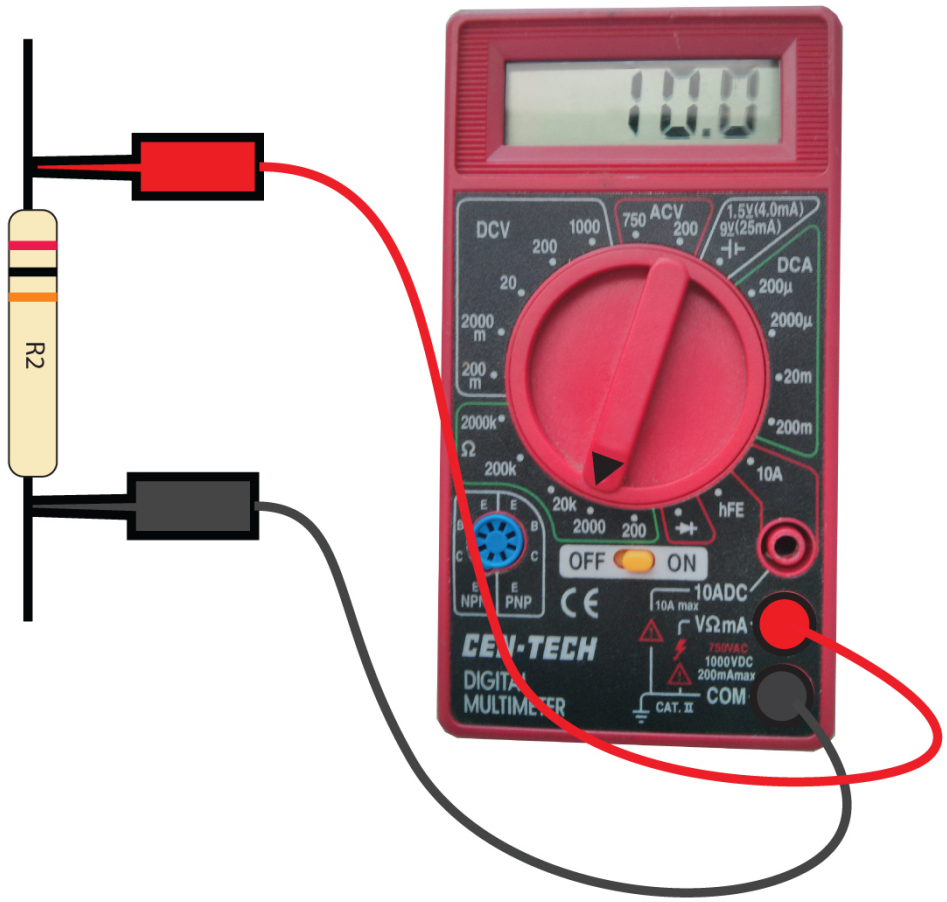
$V = Q / C_{tot}$

$V_1 = Q/C_1 \quad V_2 = Q/C_2 \quad V_3 = Q/C_3$

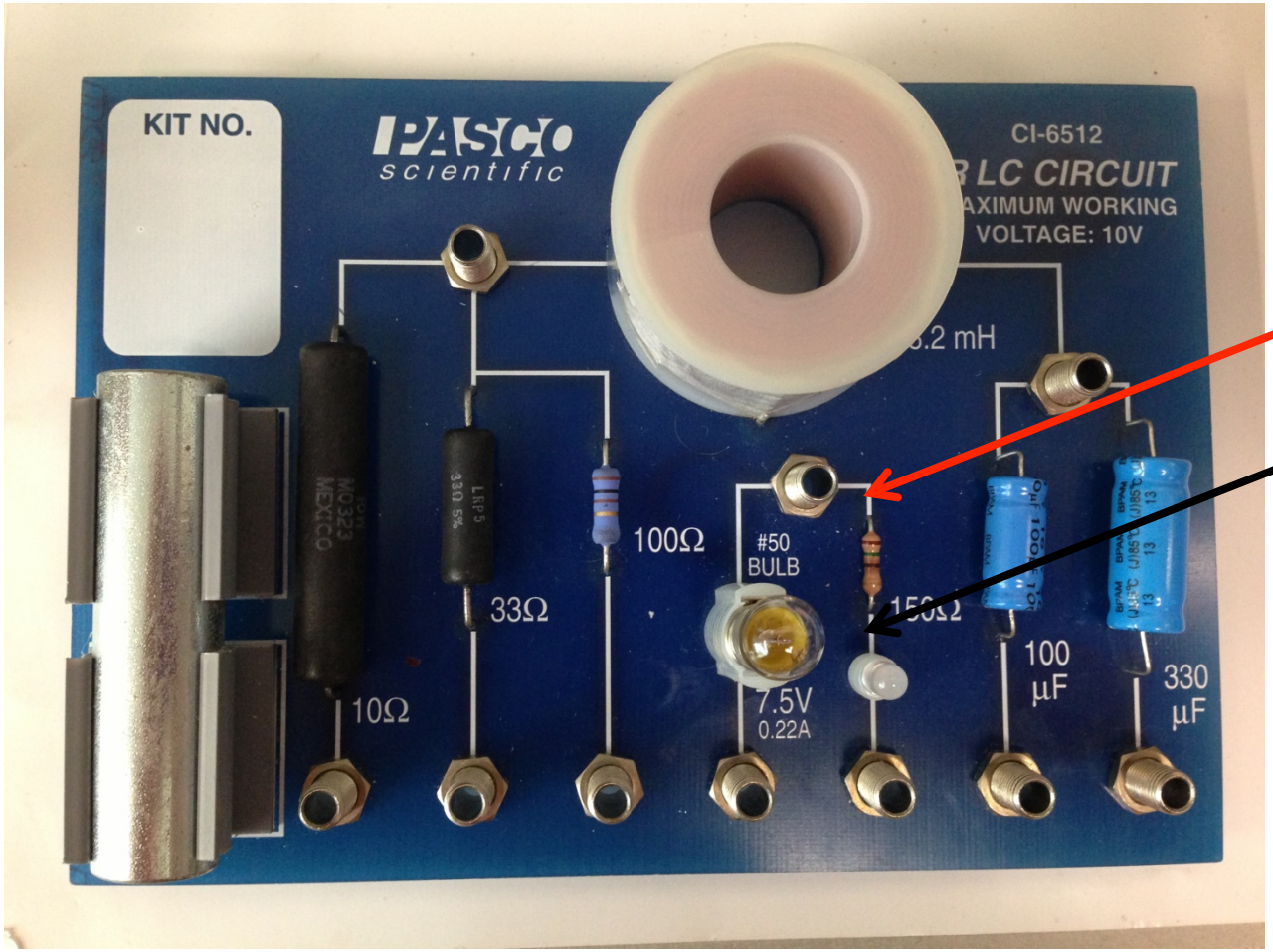
$V = V_1 + V_2 + V_3 = Q/C_1 + Q/C_2 + Q/C_3$

$1/C_{tot} = 1/C_1 + 1/C_2 + 1/C_3$

Measuring resistance



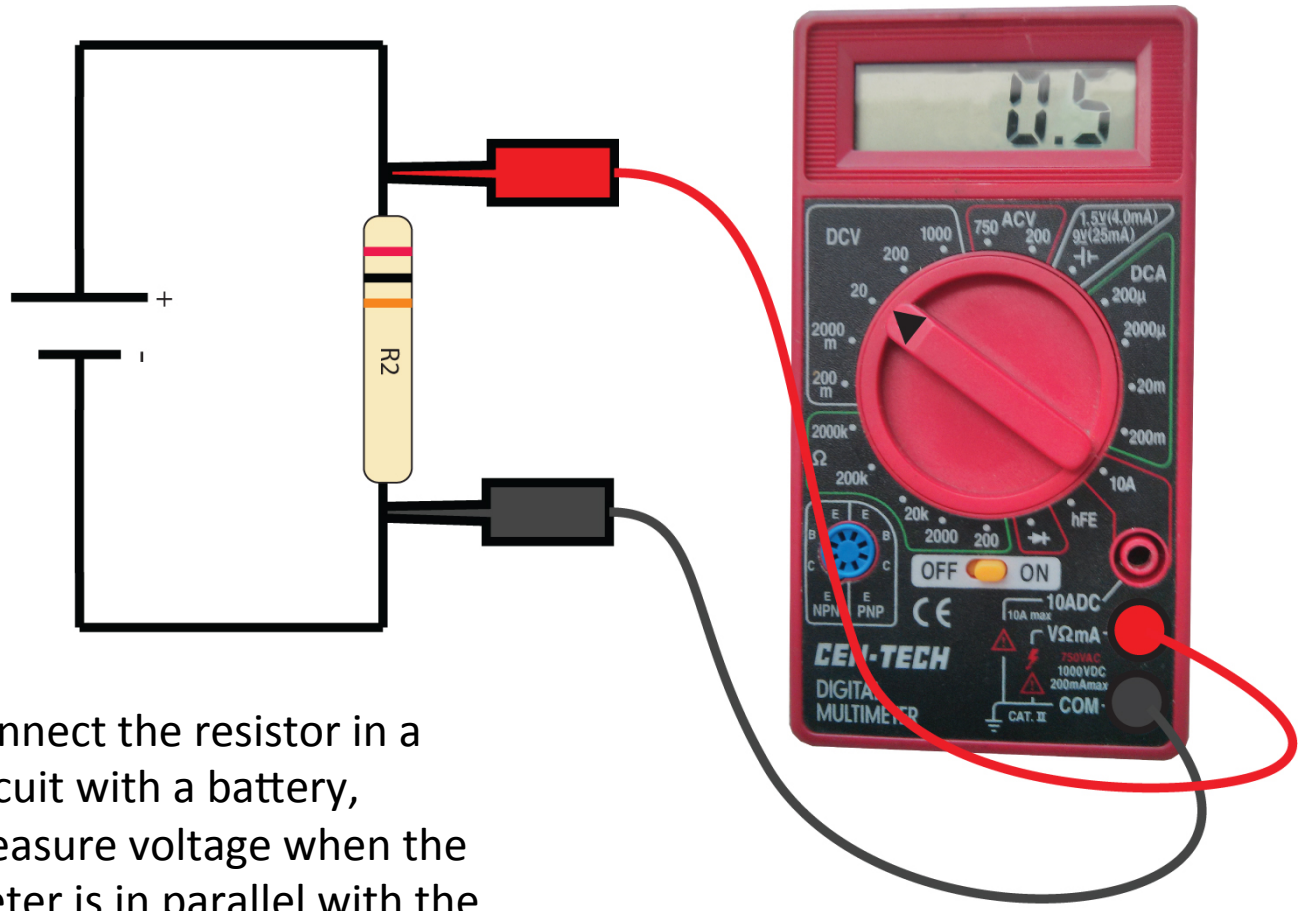
Measuring R with Pasco board



What resistance do you read?

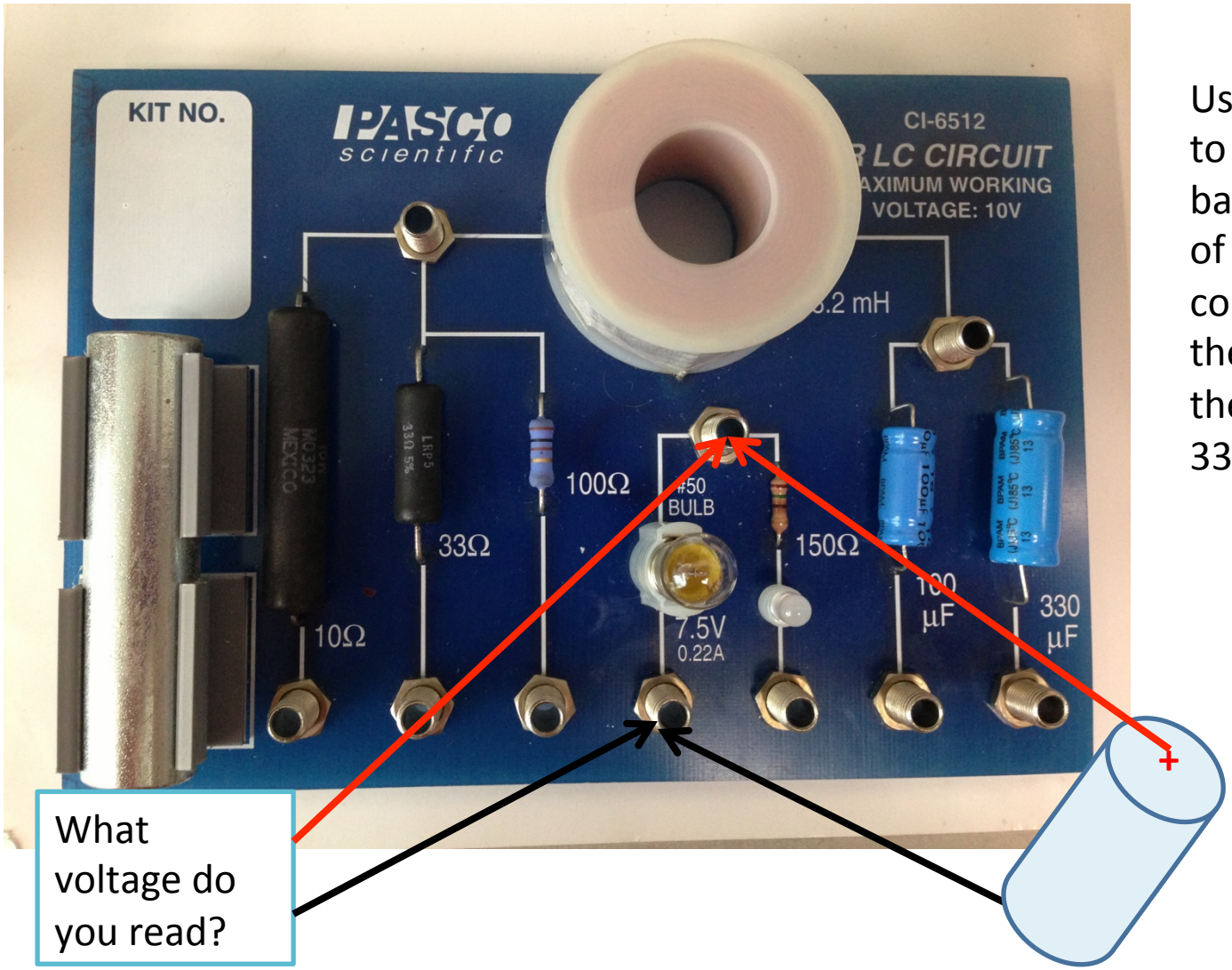
Use patch cords to try some other combinations of the resistors on the left (10 Ω, 33 Ω and 100 Ω)

Measuring voltage



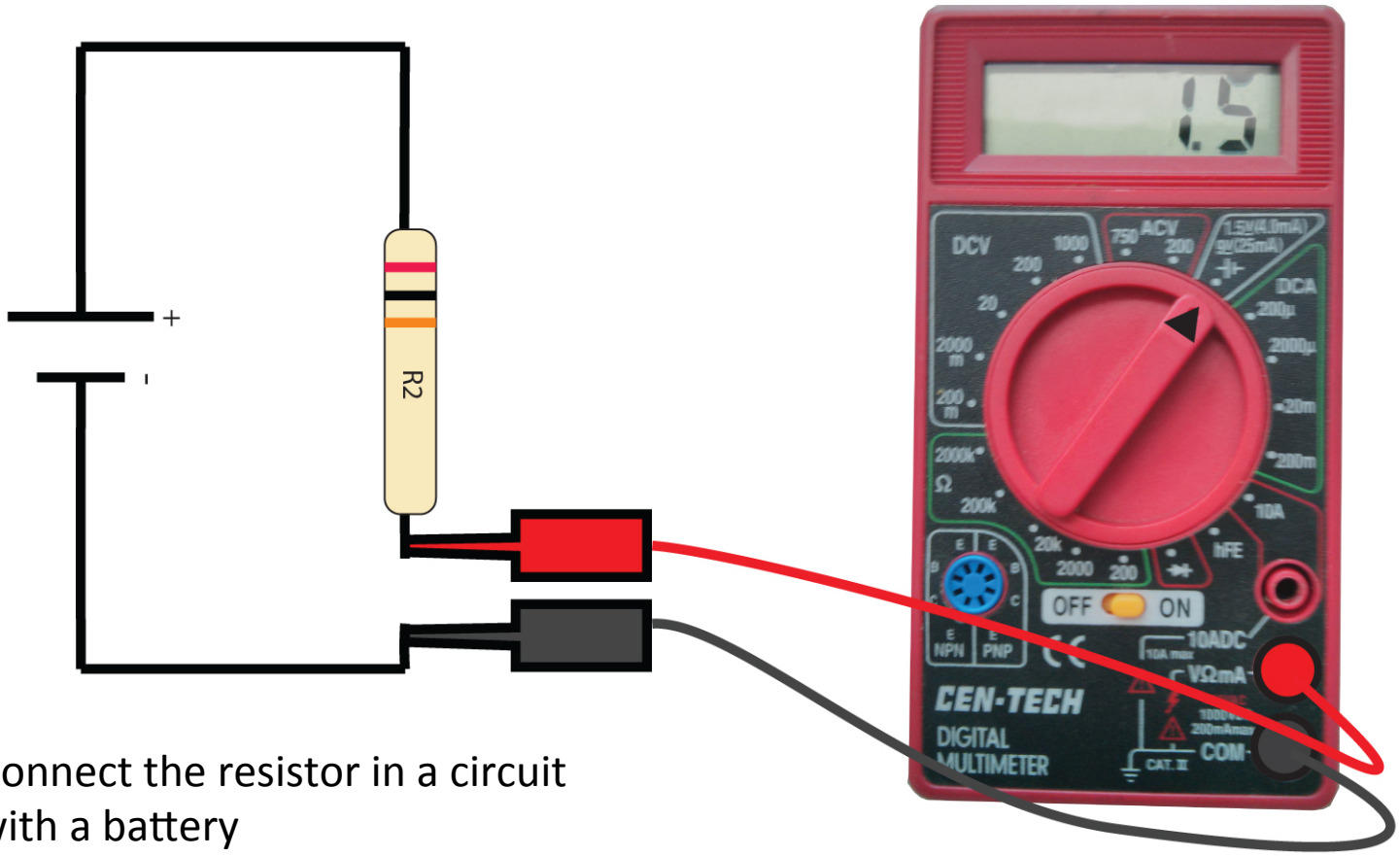
- Connect the resistor in a circuit with a battery,
- Measure voltage when the meter is in parallel with the battery and resistor

Measuring V with Pasco board



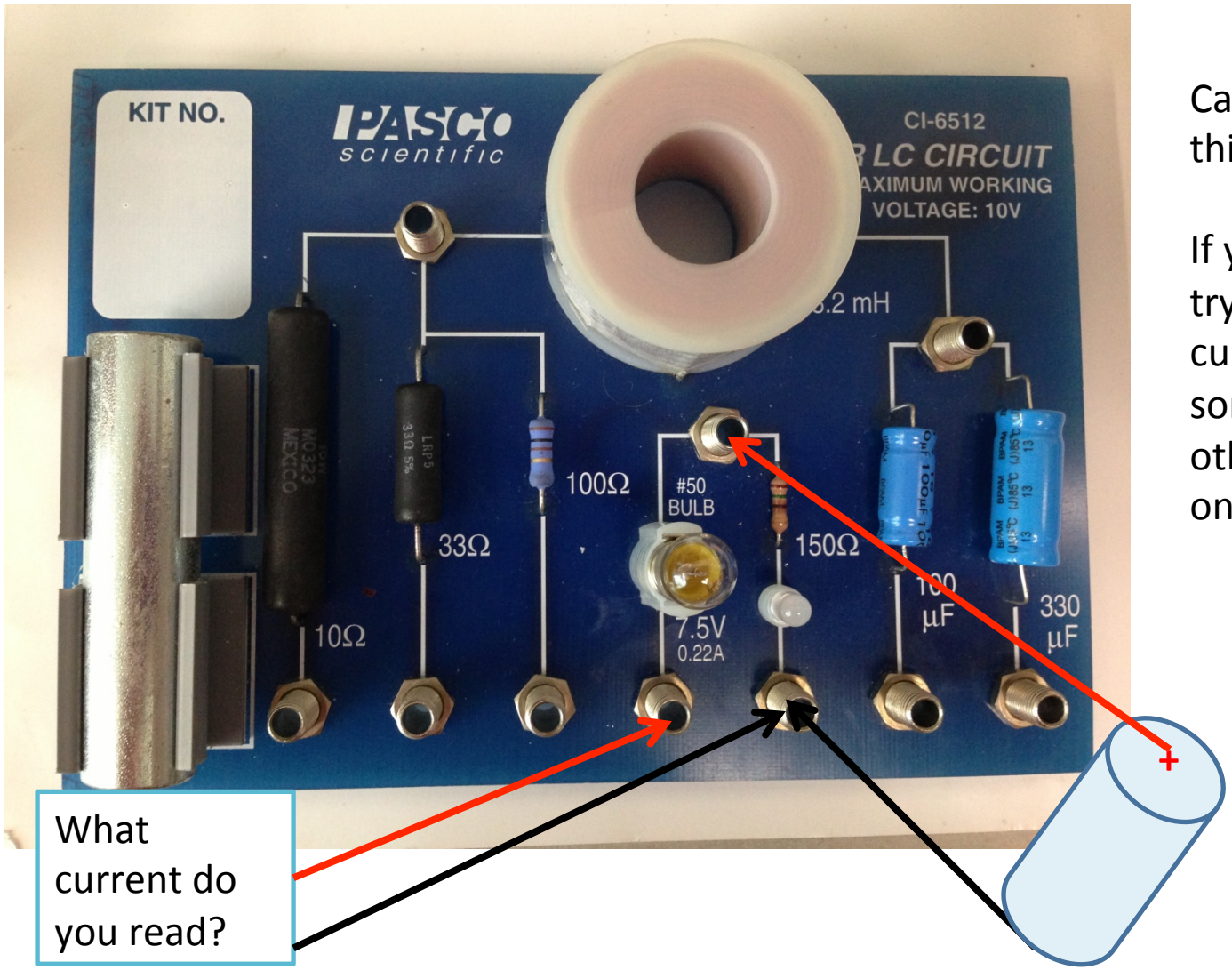
Use patch cords to attach the battery to some of the other combinations of the resistors on the left (10 Ω, 33 Ω and 100 Ω)

Measuring current



- Connect the resistor in a circuit with a battery
- Measure current when the meter is in series with the battery and resistor

Measuring I with Pasco board



Can you draw this circuit?

If you have time, try measuring current with some of the other resistors on the left.

Any questions?