Potential Dividers

IB PHYSICS | ELECTRICITY

Types of Resistors
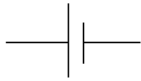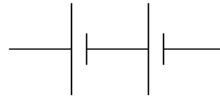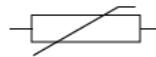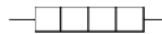
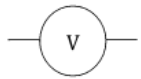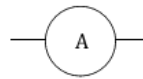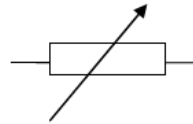|			
cell		battery	
ac supply		switch	
voltmeter	V	ammeter	A
resistor		variable resistor	
lamp		potentiometer	
light-dependent resistor (LDR)		thermistor	
transformer		heating element	
diode		capacitor	

Resistor

$$R = \rho \frac{L}{A}$$

Types of Resistors

cell	—|⊢—	battery	—|⊢—|⊢—
ac supply	—o∿o—	switch	
voltmeter	—(V)—	ammeter	—(A)—
resistor	—▭—	variable resistor	
lamp	—⊗—	potentiometer	
light-dependent resistor (LDR)		thermistor	
transformer		heating element	
diode	—▷|—	capacitor	—||—
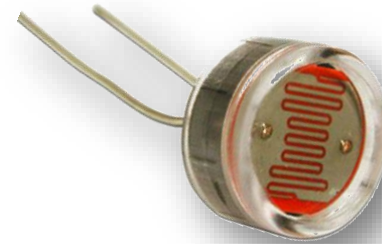
⬆ Light
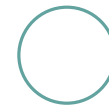
◯ Resistance

Inverse Relationship

Types of Resistors

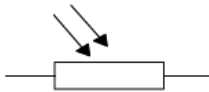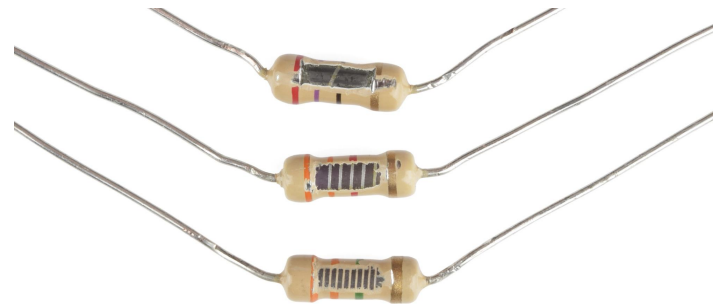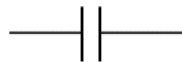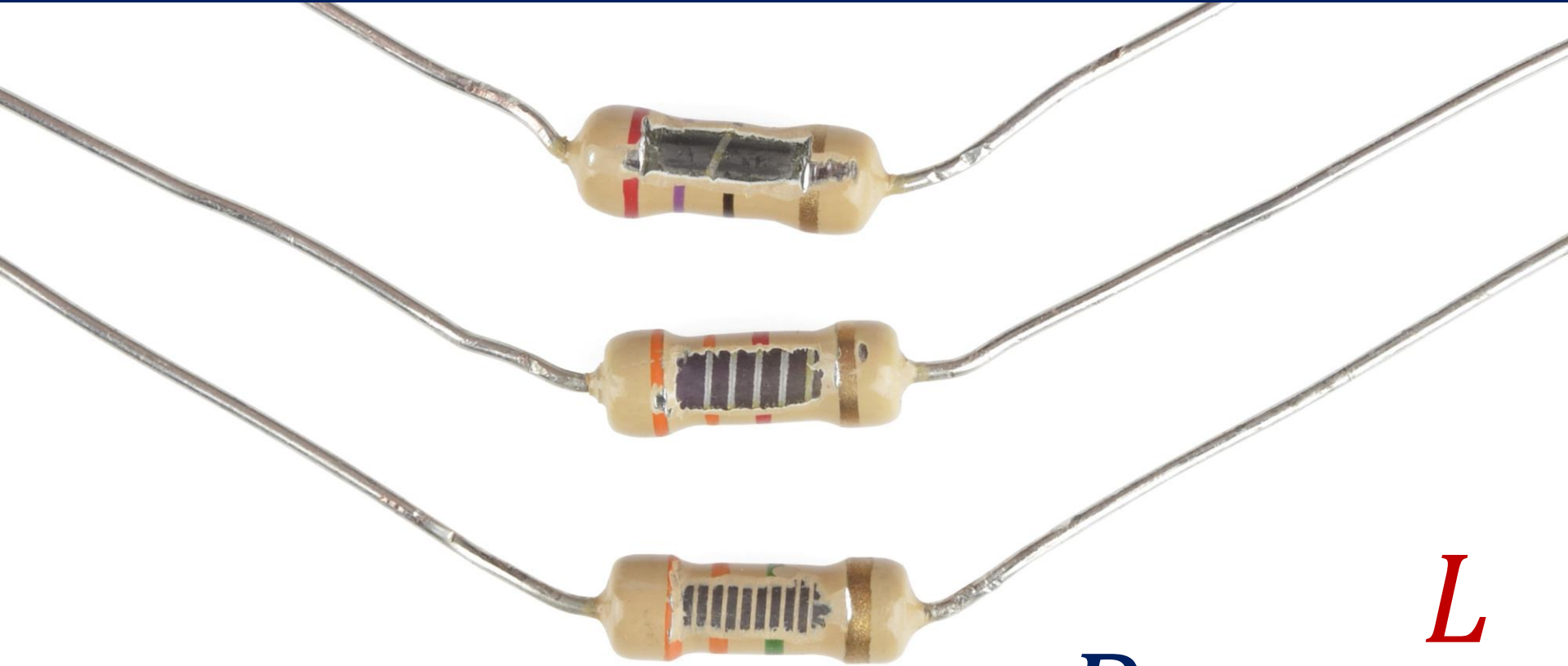|	
cell	battery
ac supply	switch
voltmeter (V)	ammeter (A)
resistor	variable resistor
lamp	potentiometer
light-dependent resistor (LDR)	thermistor
transformer	heating element
diode	capacitor

↑ Heat

◯ Resistance

Inverse Relationship

Types of Resistors

Potential Divider

"potential difference"

Battery

p.d.

p.d.

30Ω

p.d.

10Ω

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Each resistor has a "voltage drop"

120.0 V

10.0 Ω

30.0 Ω

Voltage
?

Potential Divider

V_{in}

R_1

R_2
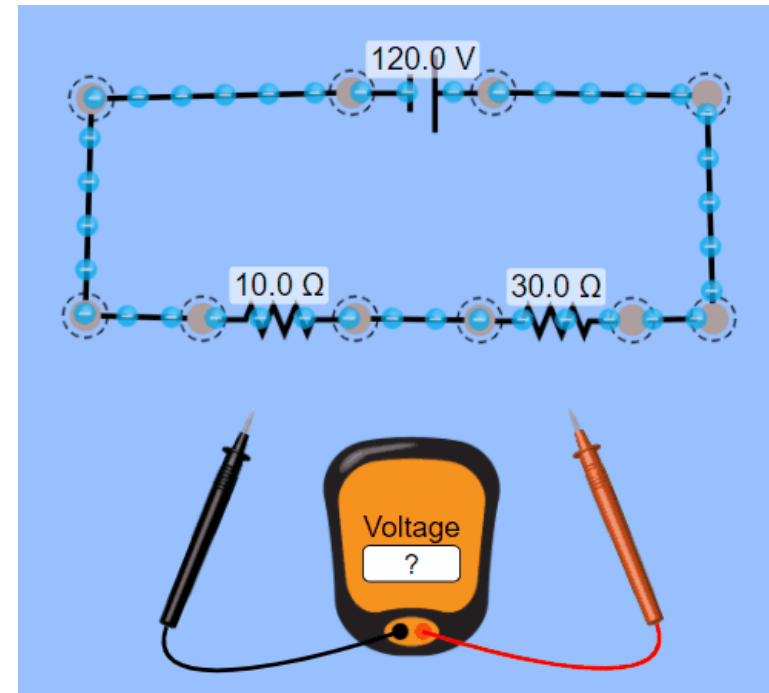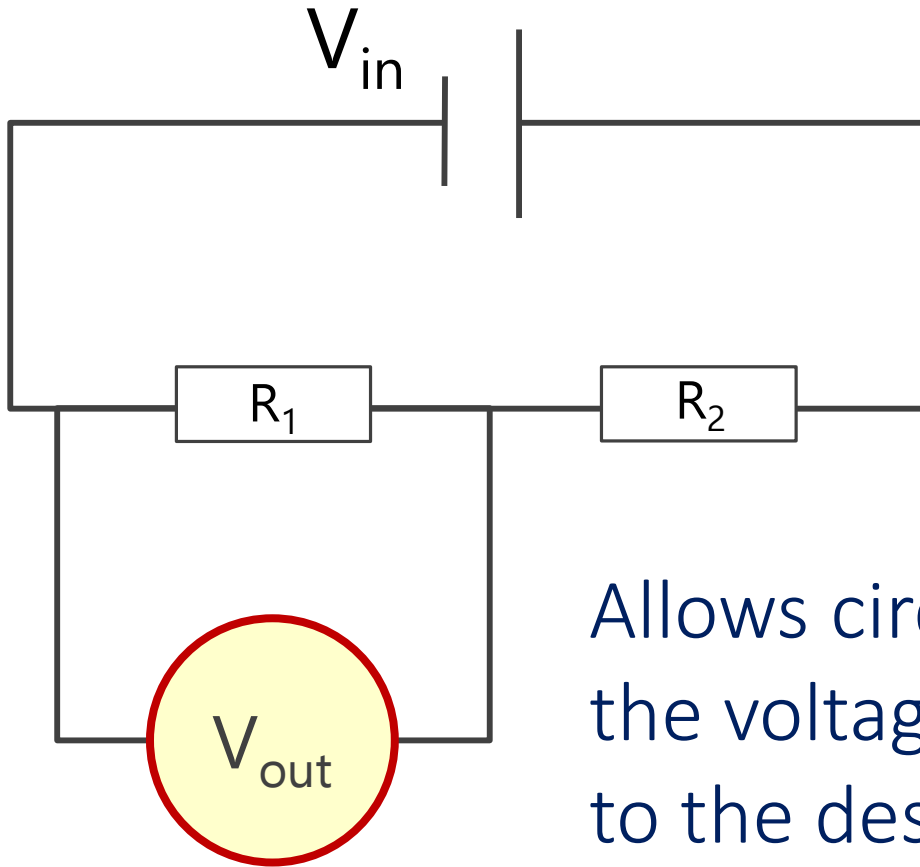
V_{out}

Allows circuit designers to tune the voltage that is being delivered to the desired components

Relationship between R_1 and V_{out}

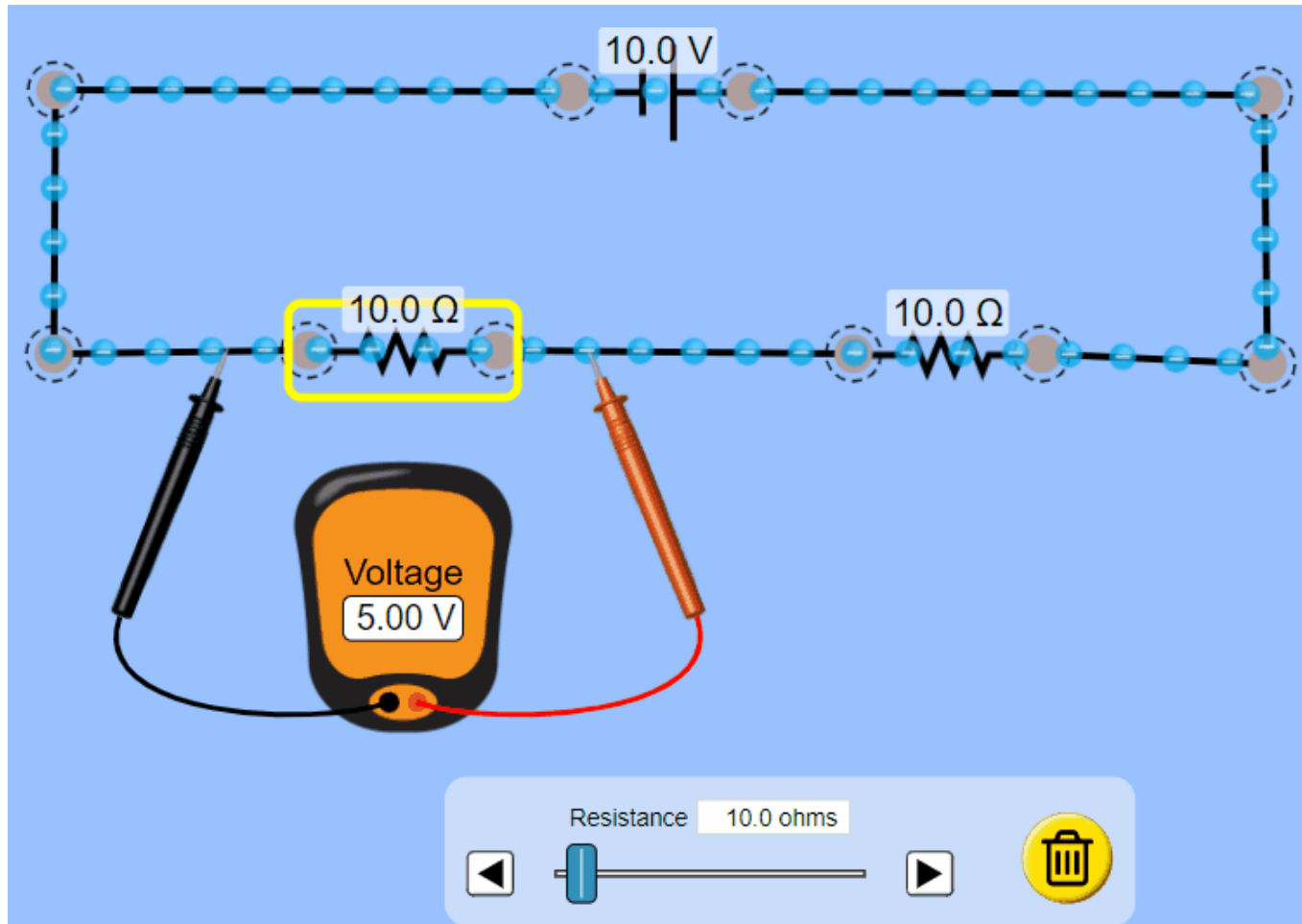# Relationship between R_2 and V_{out}
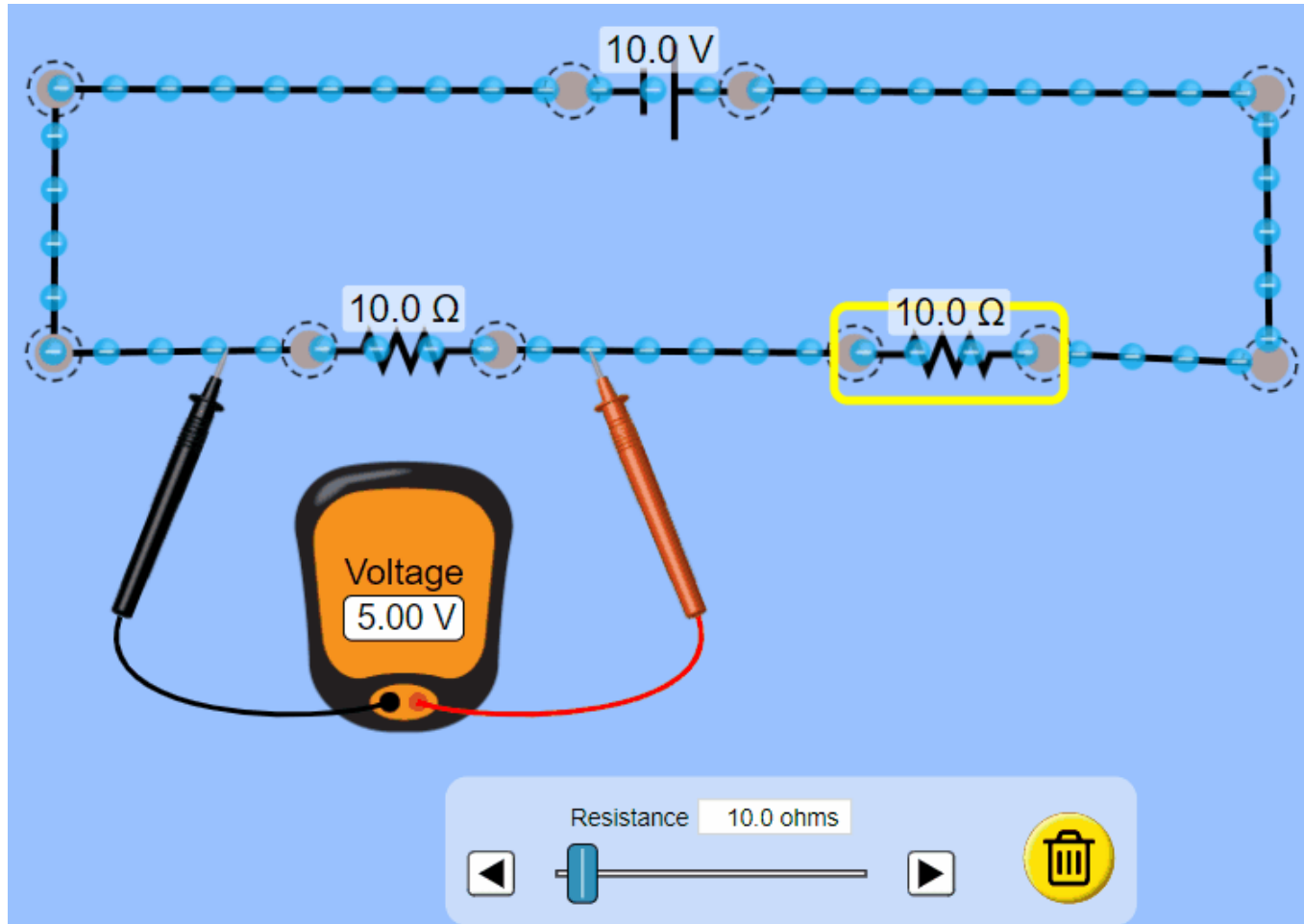
Potential Divider
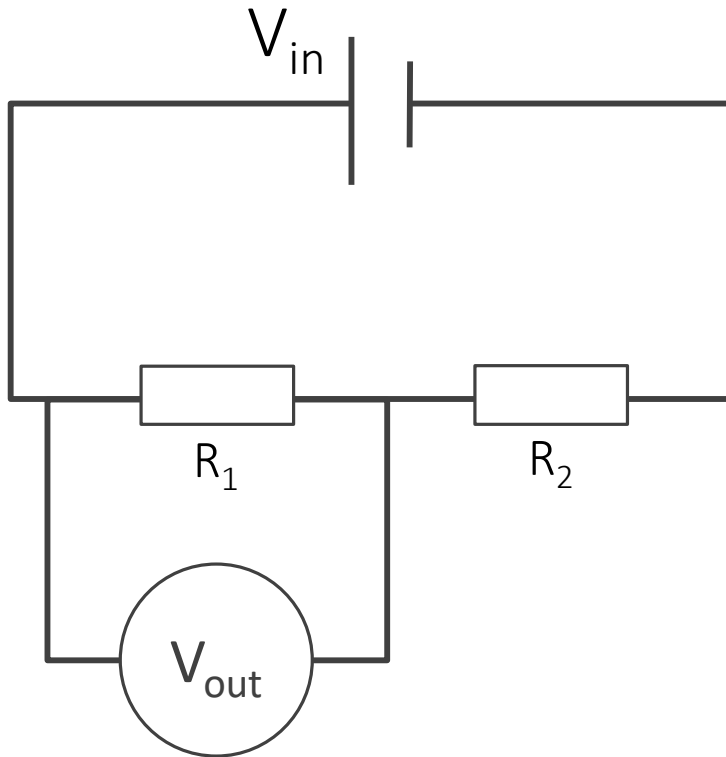
Relationship between R_1 and V?

Relationship between R_2 and V?
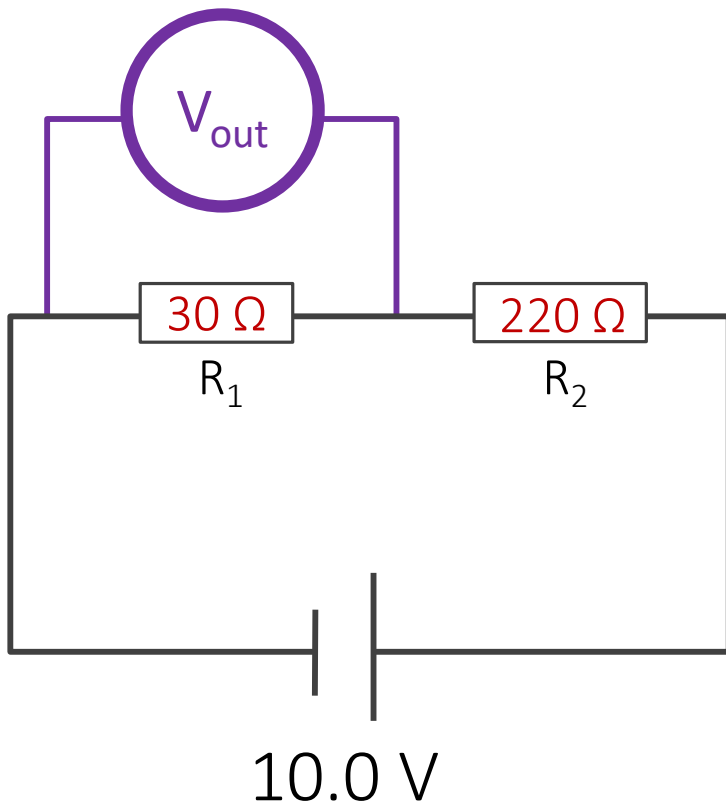
Potential Divider

Find the Output Voltage:

	V	I	R
R$_1$			30 Ω
R$_2$			220 Ω
Total	10 V		

10.0 V

Applications of LDRs

Designed to perform function when the amount of light changes

No internet
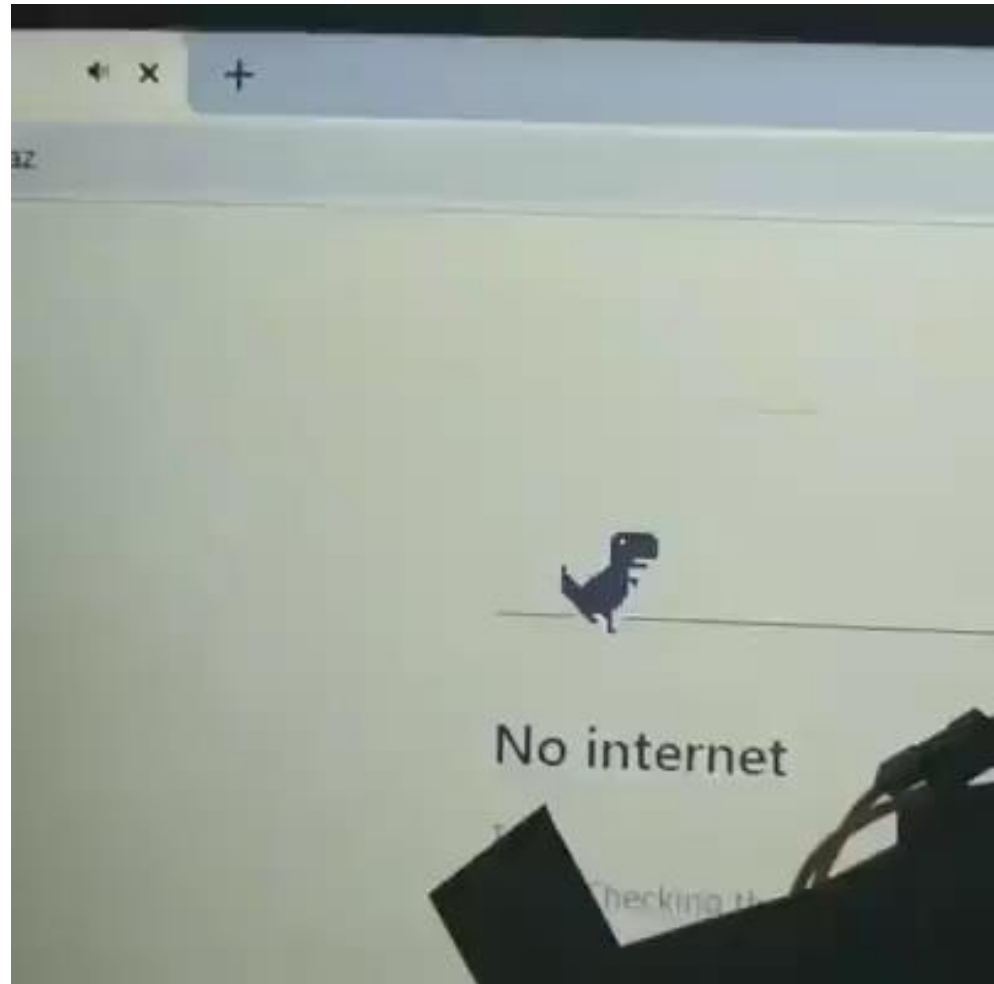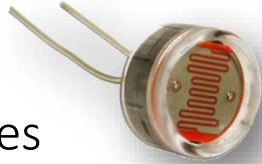
Potential Divider | Night Light
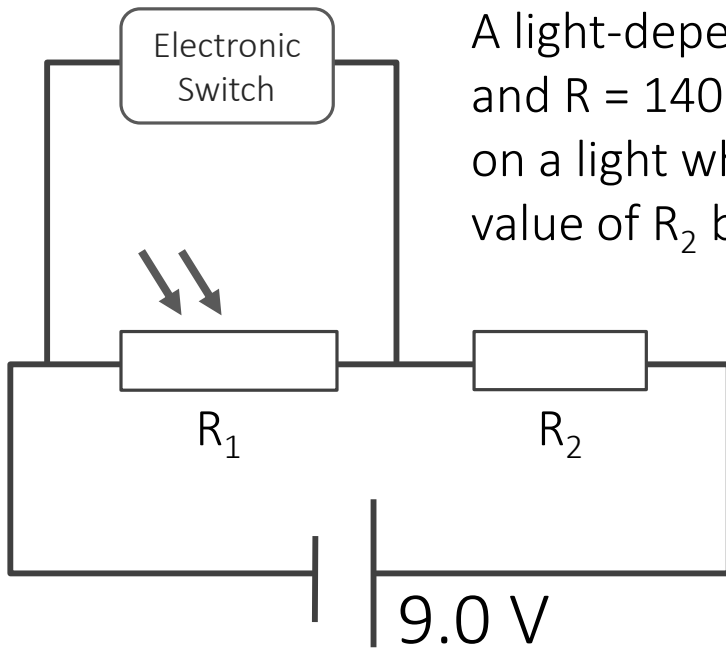
A light-dependent resistor (LDR) has R = 8 Ω in bright light and R = 140 Ω in low light. An electronic switch will turn on a light when its p.d. is above 7.0 V. What should the value of R_2 be?

*Night light should turn on in low light

	V	I	R
R_1			
R_2			
Total			

Electronic Switch

R_1

R_2

9.0 V

Potential Divider | Sprinkler System

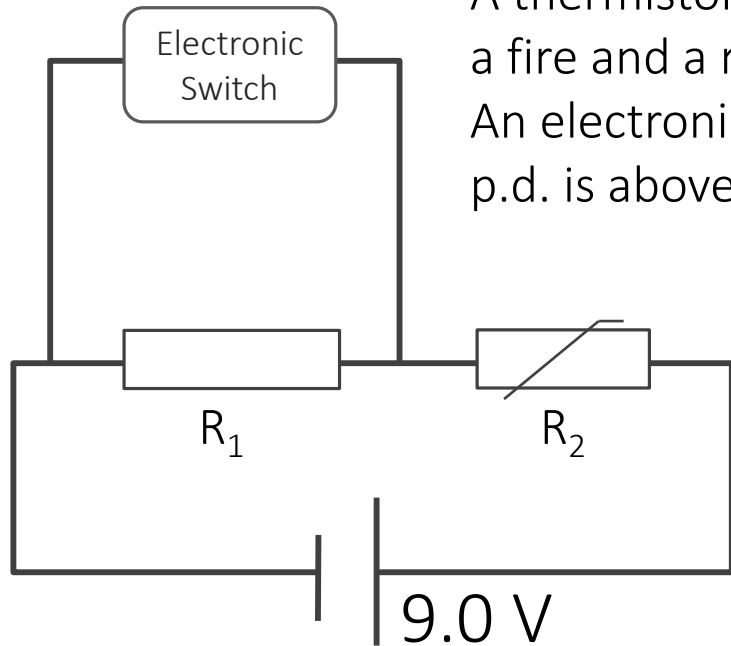A thermistor has a resistance of 2.5 Ω when it is in the heat of a fire and a resistance of 650 Ω in when at room temperature. An electronic switch will turn on a sprinkler system when its p.d. is above 6.0 V. What should the value of R_1 be?

*Sprinkler should activate when hot

Electronic Switch

R_1

R_2

9.0 V

	V	I	R
R_1			
R_2			
Total			

Lesson Takeaways

❑ I can identify the different circuit diagram symbols for different types of resistors

❑ I can describe how environmental changes can affect the resistance of LDRs and Thermistors

❑ I can describe how changing resistor values can affect the voltage drop in a potential divider circuit

❑ I can design a potential divider circuit to perform a certain task