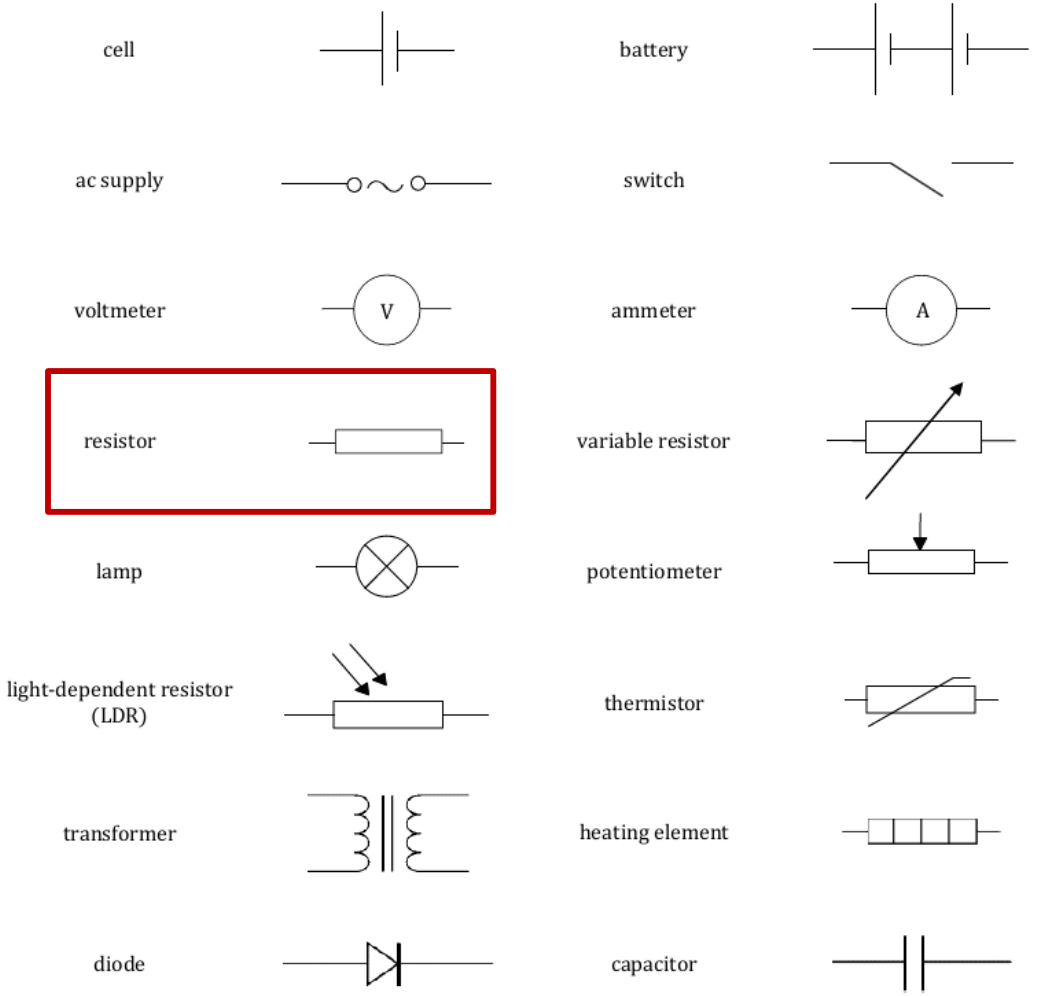
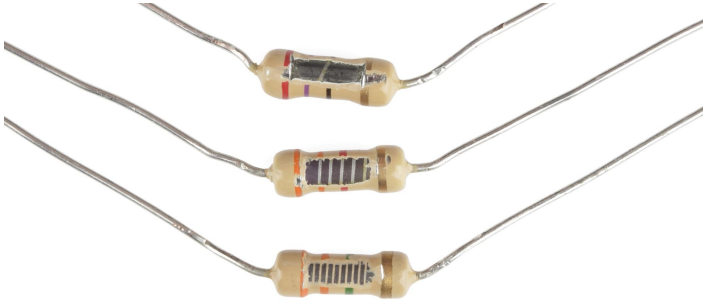
Potential Dividers

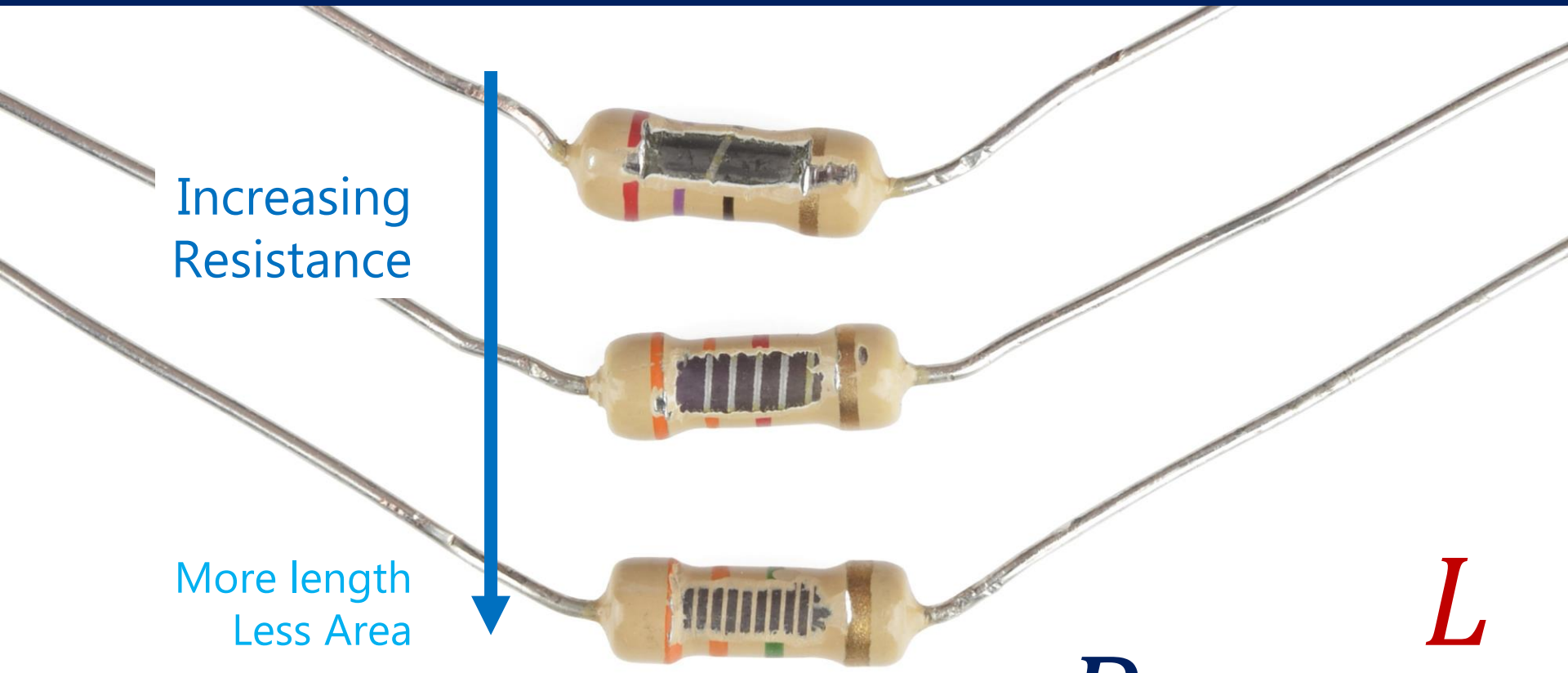
IB PHYSICS | ELECTRICITY

Types of Resistors



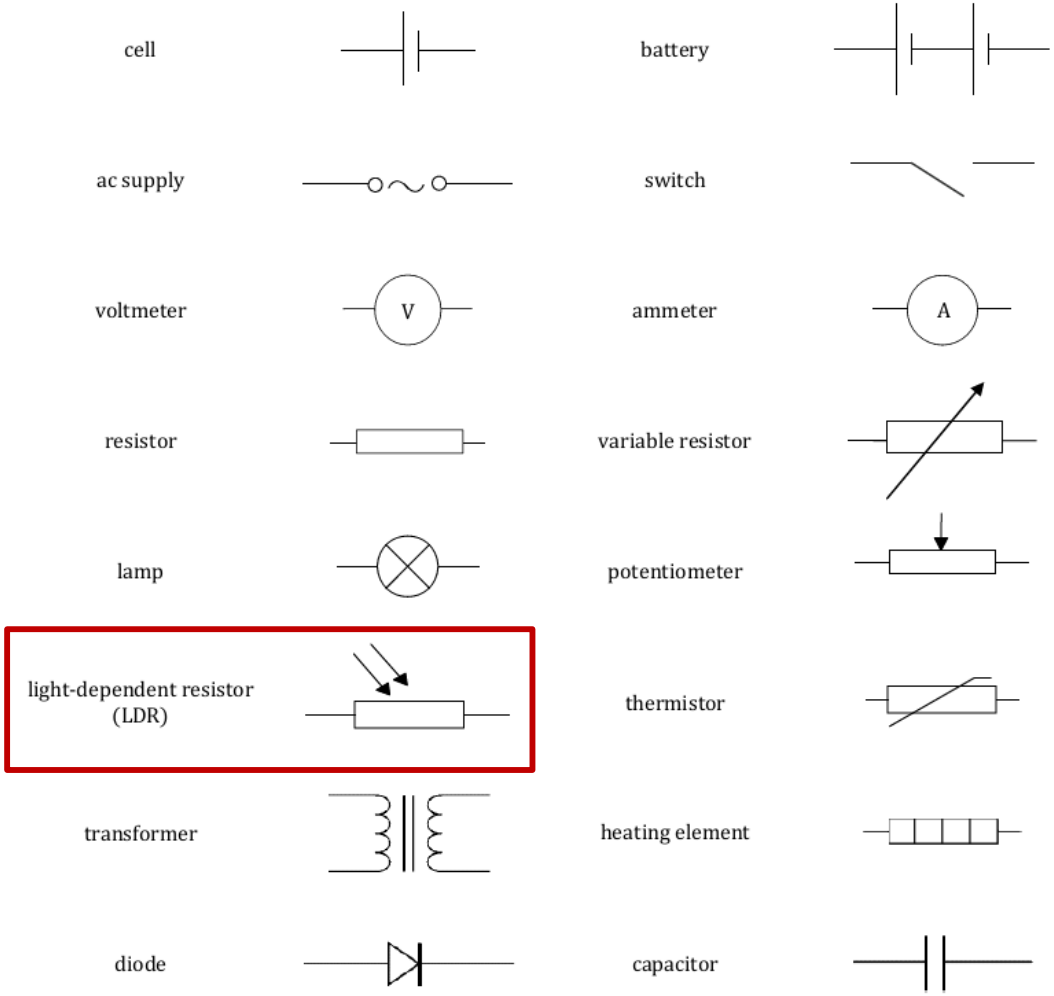


Resistor



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

Types of Resistors

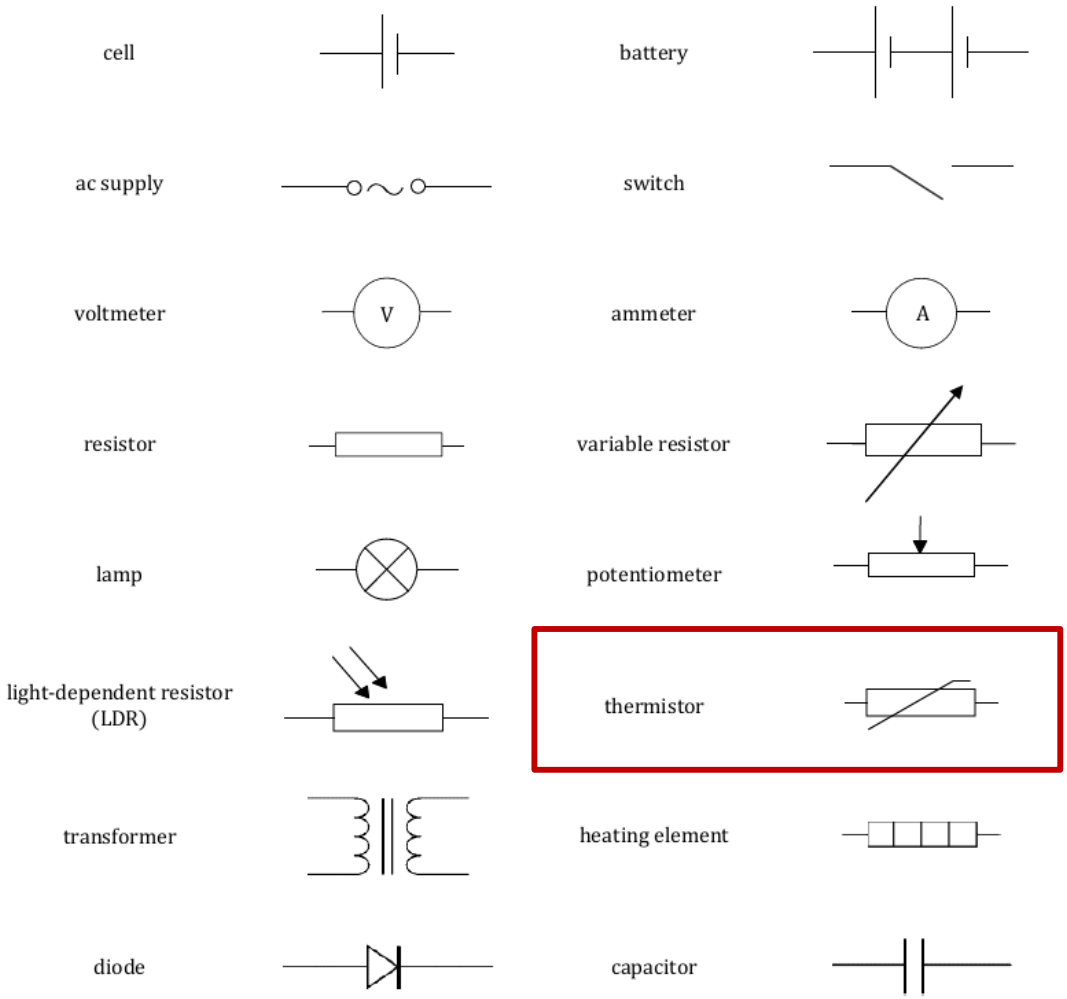


Light

Resistance

Inverse Relationship

Types of Resistors

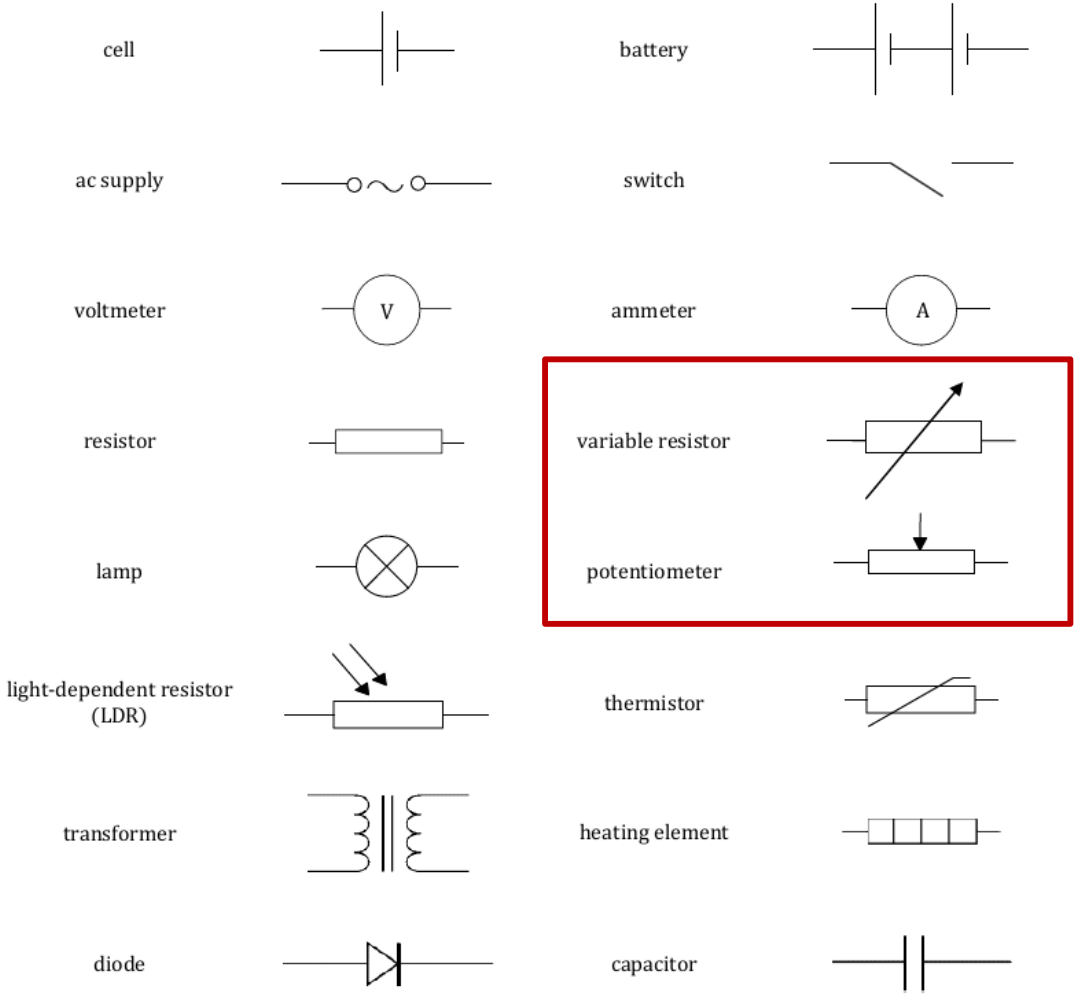


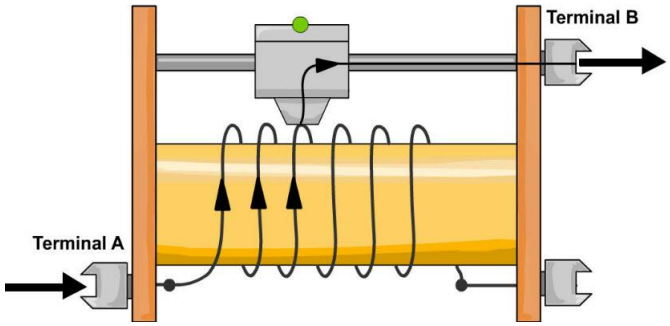
Heat

Resistance

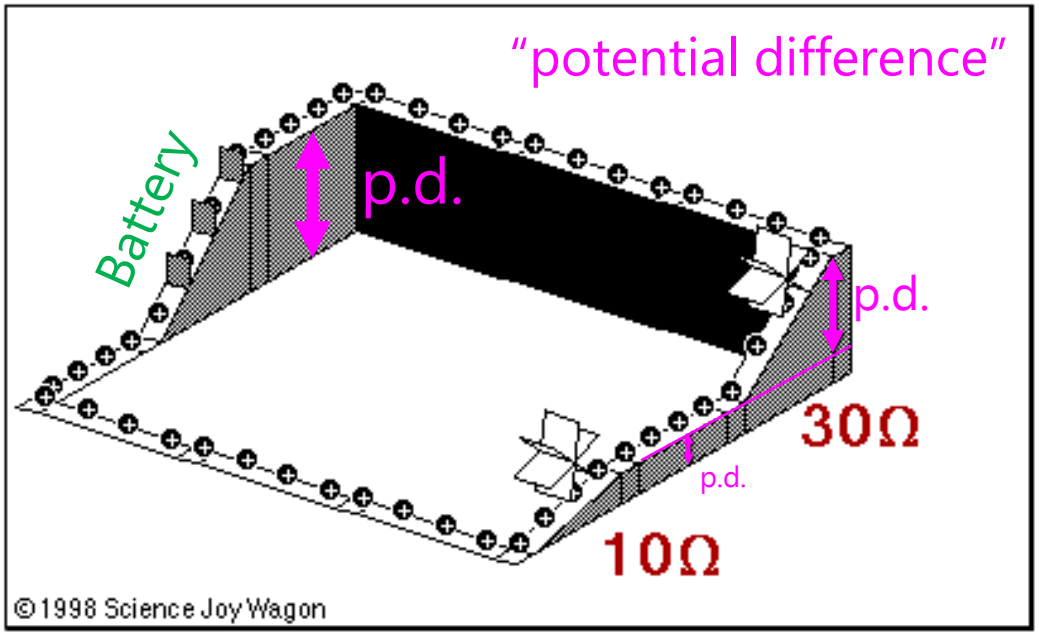
Inverse Relationship

Types of Resistors



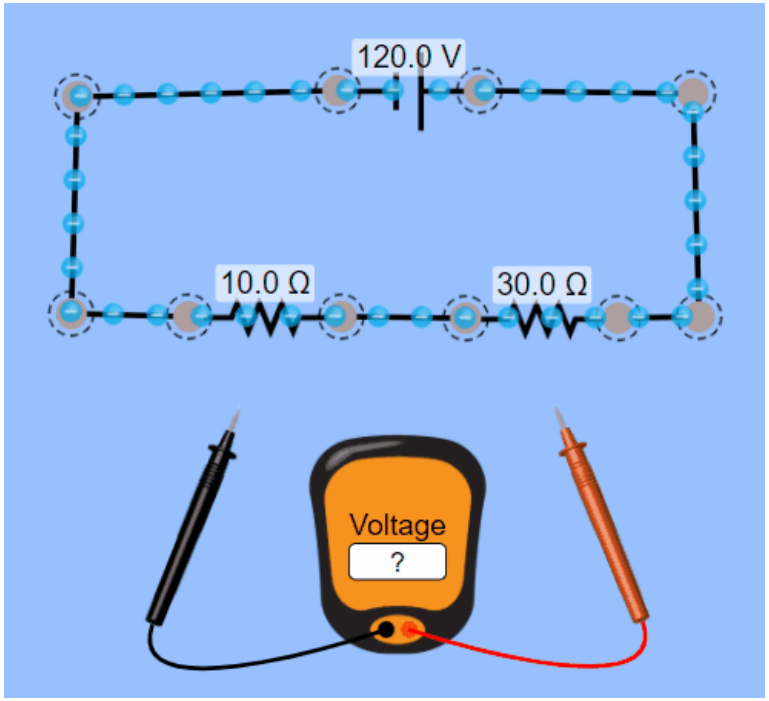


Potential Divider

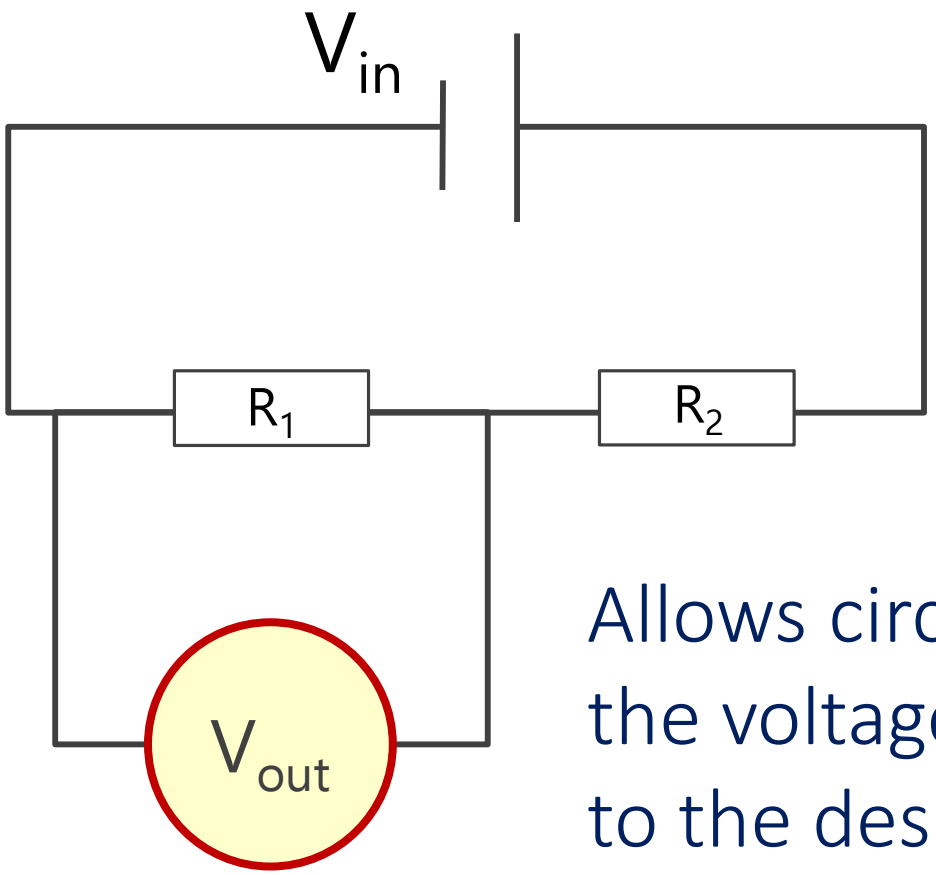


The total voltage supplied by the battery is "divided" across the different resistors

Each resistor has a "voltage drop"

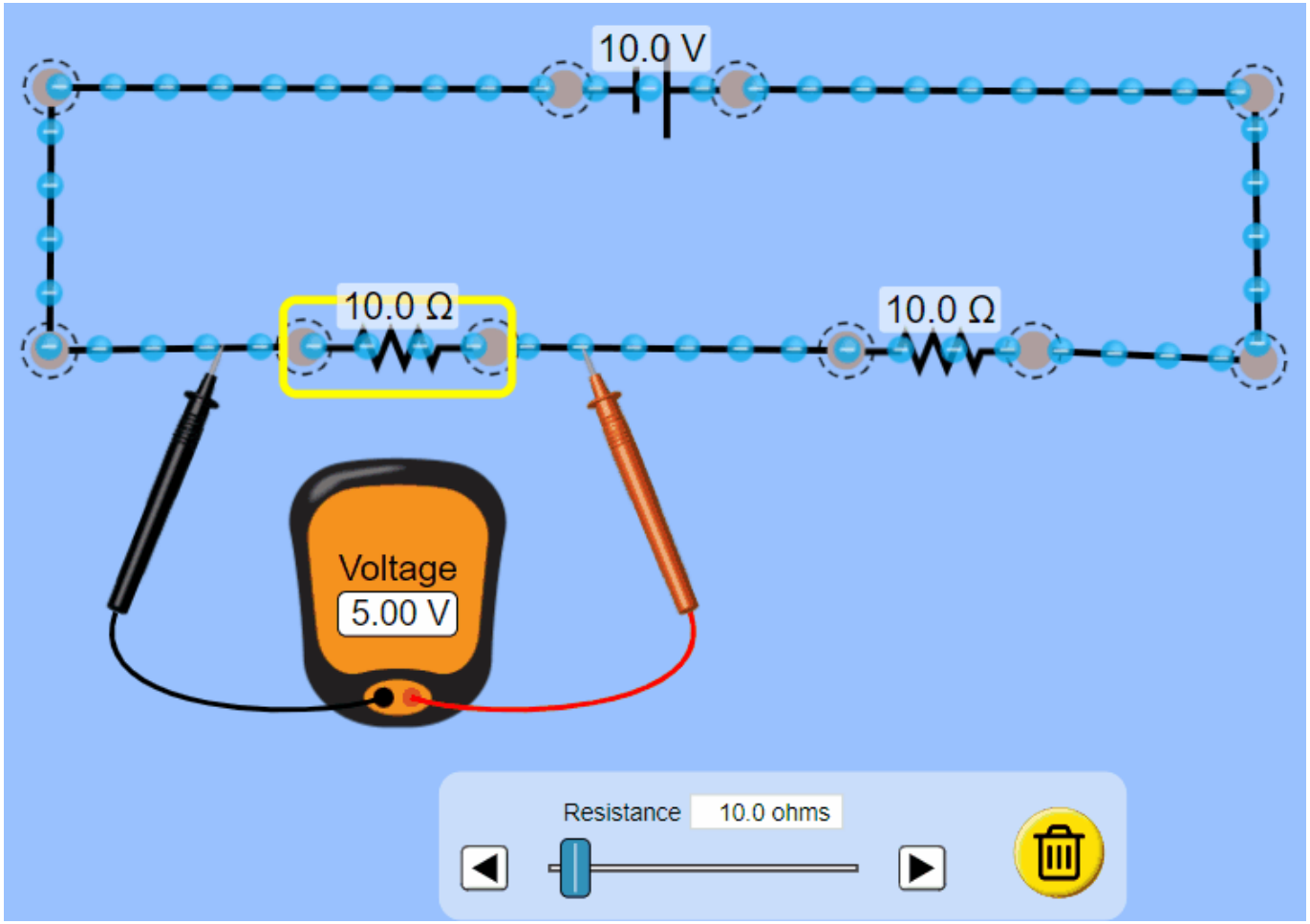


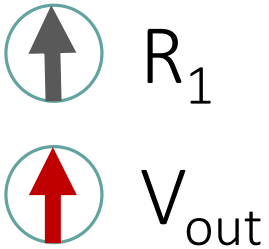
Potential Divider

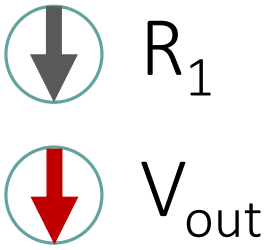


Allows circuit designers to tune the voltage that is being delivered to the desired components

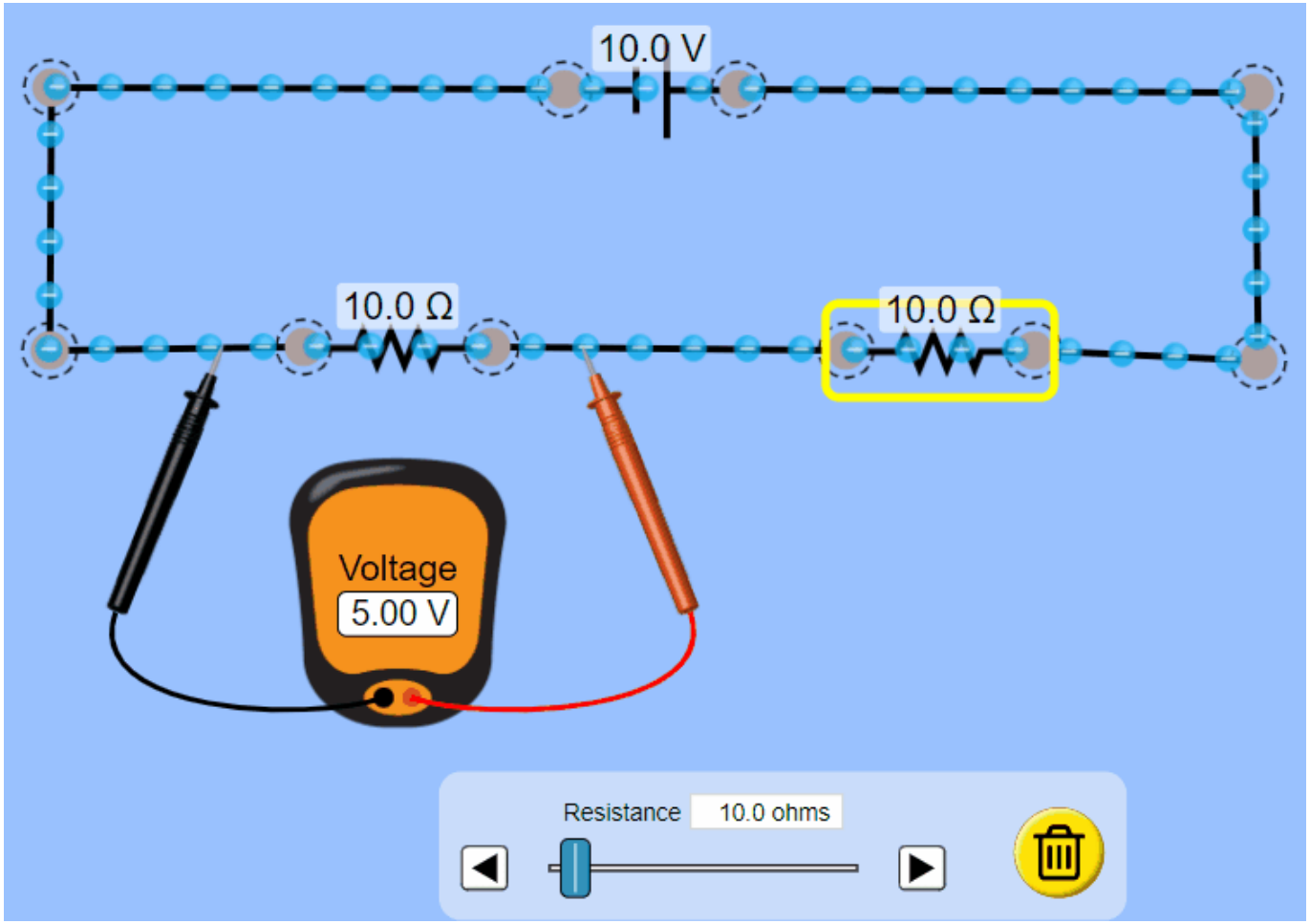
Relationship between R_1 and V_{out}







Relationship between R_2 and V_{out}



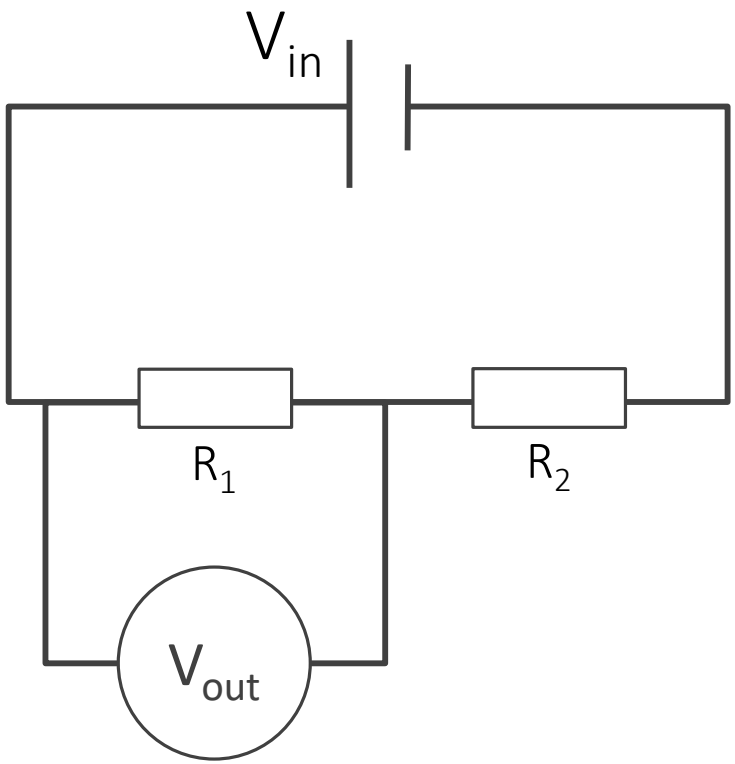
R_2

V_{out}

R_2

V_{out}

Potential Divider



Relationship between R_1 and V?


R_1


V_{out}


R_1


V_{out}

Relationship between R_2 and V?


R_2

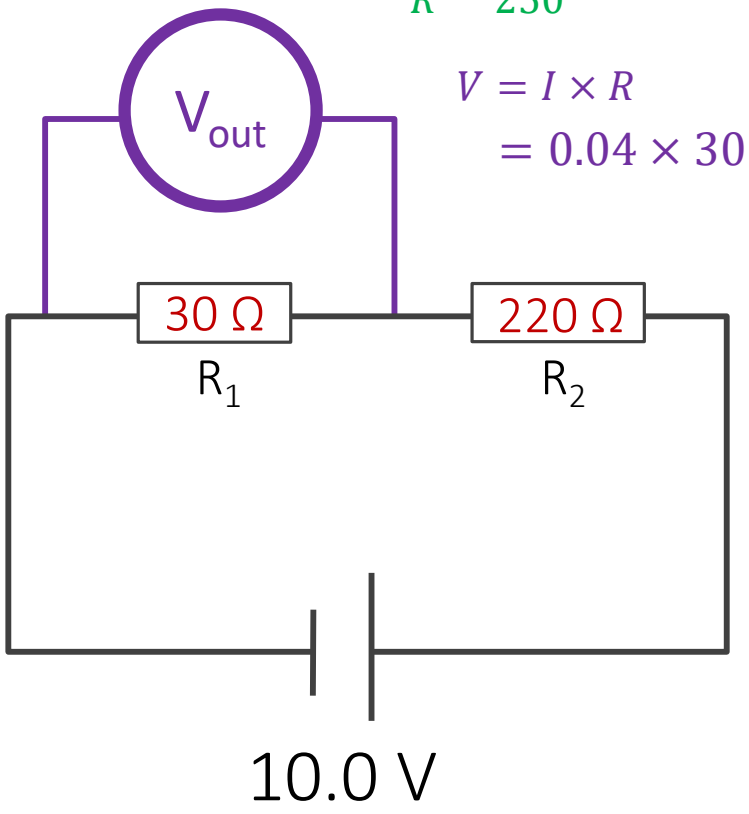

V_{out}


R_2


V_{out}

Potential Divider

$$I_T = \frac{V}{R} = \frac{10}{250} = 0.04\ \text{A}$$



$$V = I \times R$$
$$= 0.04 \times 30$$

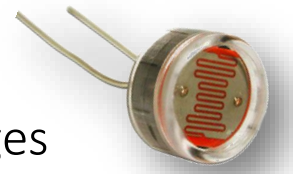
Find the Output Voltage:

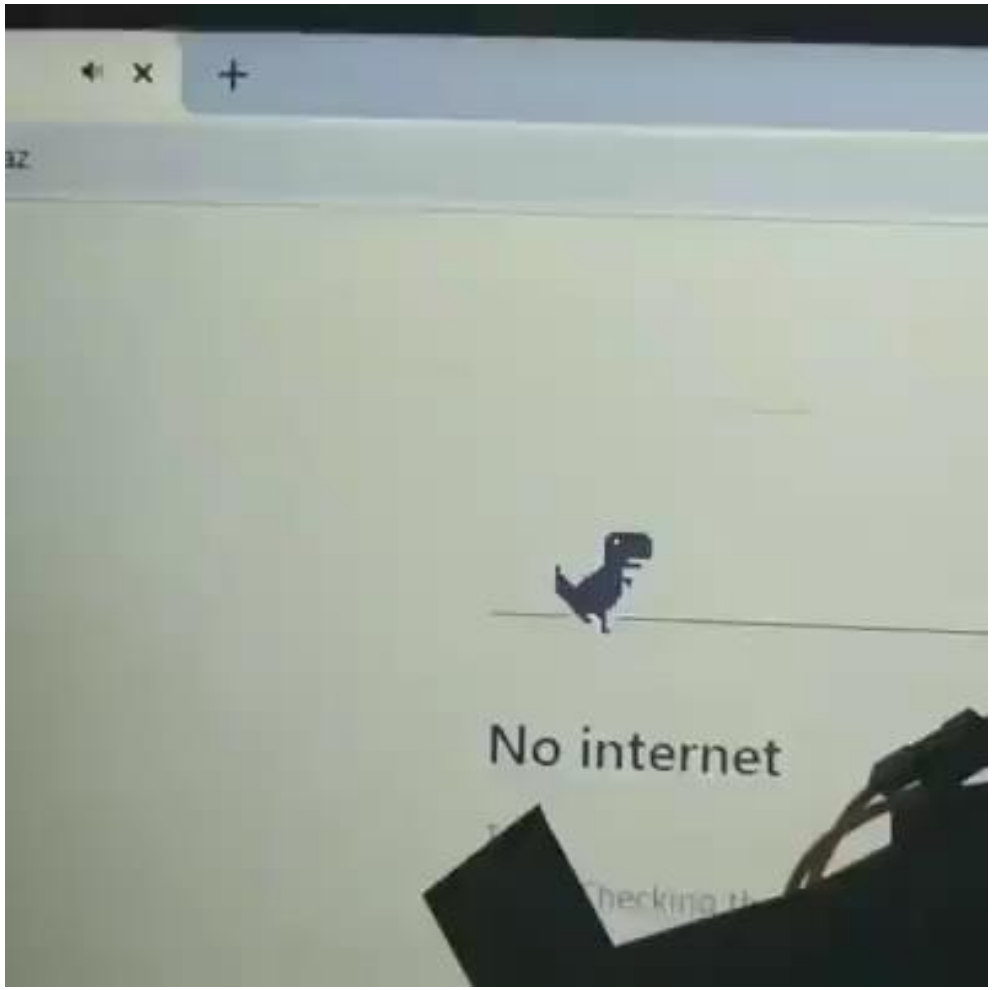
	V	I	R
R_1	**1.2 V**	0.04 A	30 Ω
R_2		0.04 A	220 Ω
Total	10 V	0.04 A	250 Ω

1. Calculate total resistance and current
2. Current is the same for each resistor
3. Calculate voltage across R_1

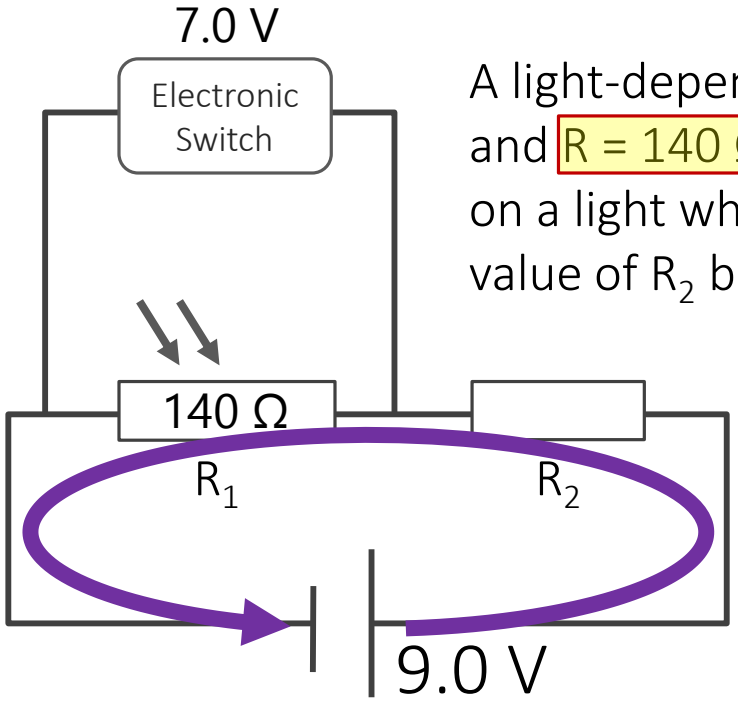
Applications of LDRs

Designed to perform function when the amount of light changes





Potential Divider | Night Light



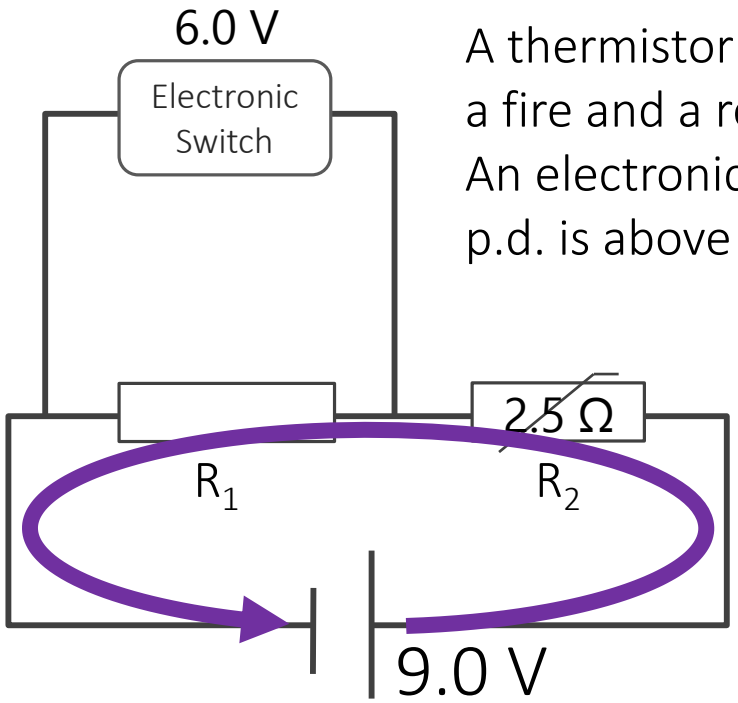
A light-dependent resistor (LDR) has R = 8 Ω in bright light and R = 140 Ω in low light. An electronic switch will turn on a light when its p.d. is above 7.0 V. What should the value of R_2 be?

*Night light should turn on in low light

	V	I	R
R_1	7.0 V	0.05 A	140 Ω
R_2	2.0 V	0.05 A	40 Ω
Total	9.0 V	0.05 A	

1. Calculate current through R_1
2. Current is the same throughout circuit (no current through switch)
3. Use voltage loop to find voltage across R_2
4. Calculate resistance of R_2

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

	V	I	R
R_1	6.0 V	1.2 A	5 Ω
R_2	3.0 V	1.2 A	2.5 Ω
Total	9.0 V	1.2 A	

1. Use voltage loop to find voltage across R_2
2. Calculate current through R_2
3. Current is the same throughout circuit (no current through switch)
4. Calculate resistance of R_1

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