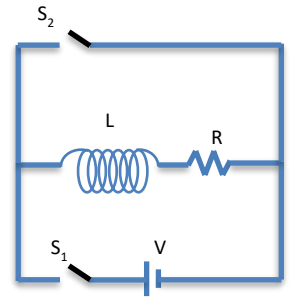


CONCEPT: LR CIRCUITS

- LR (or RL) Circuits are circuits containing _____ and _____

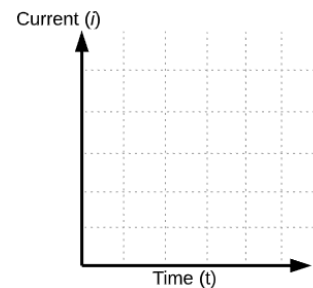
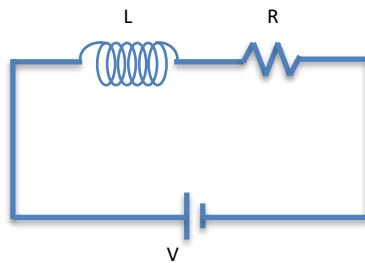
- Depending on the switch positions, there are two processes happening in this circuit:

- CURRENT GROWTH: S_2 open and S_1 closed, current [**INCREASES** | **DECREASES**]
- CURRENT DECAY: S_1 open and S_2 closed, current [**INCREASES** | **DECREASES**]



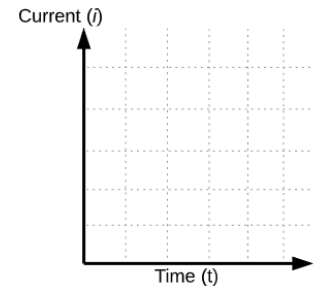
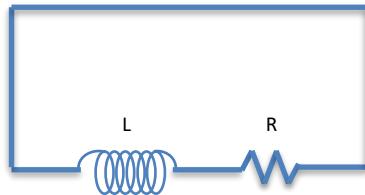
- CURRENT GROWTH: Current starts from [**ZERO** | **MAX**]; inductor resists growing current, eventually reaches _____

$$i(t) = \frac{V}{R} (1 - e^{-t/\tau})$$



- CURRENT DECAY: Current starts from [**ZERO** | **MAX**]; inductor resists decreasing current, eventually reaches _____

$$i(t) = \frac{V}{R} e^{-t/\tau}$$



- The TIME CONSTANT, $\tau = \frac{L}{R}$, determines the how quickly growth and decay occurs

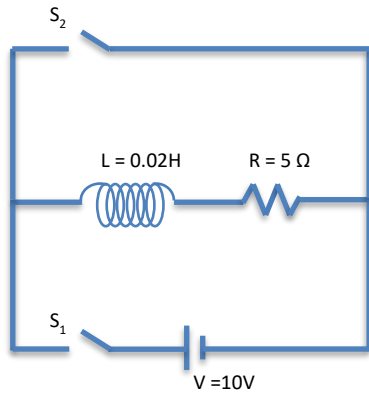
- Lower time constants $\rightarrow$ [**FASTER** | **SLOWER**] changes in current
- Higher time constants $\rightarrow$ [**FASTER** | **SLOWER**] changes in current

EXAMPLE: UNKNOWN RESISTANCE IN LR CIRCUIT

An LR circuit has a time constant of 0.025 s and is initially connected to a 10 V battery. If after 0.005 s of being disconnected from the battery, the current is 0.5 A, what is the resistance of the circuit?

PRACTICE: UNKNOWN CURRENT IN AN LR CIRCUIT

Consider the LR circuit shown below. Initially, both switches are open. Switch 1 is closed. **a)** What is the maximum current in the circuit after a long time? Then, S_1 is opened and S_2 is closed. **b)** What is the current in the circuit after 0.05s?



PRACTICE: TIME TO HALF MAXIMUM CURRENT

An LR circuit with $L = 0.1 \text{ H}$ and $R = 10 \text{ } \Omega$ are connected to a battery with the circuit initially broken. When the circuit is closed, how much time passes until the current reaches half of its maximum value?