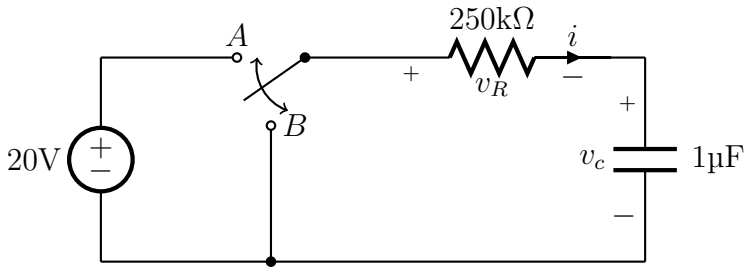
- Homework is due at the beginning of class
- Start early and get help if you need it
- Show all work neatly and clearly; redraw and/or rewrite problem if needed as work turned in should stand alone
- Identify your answers (with units) using a box, circle or underline
- Staple multiple pages together

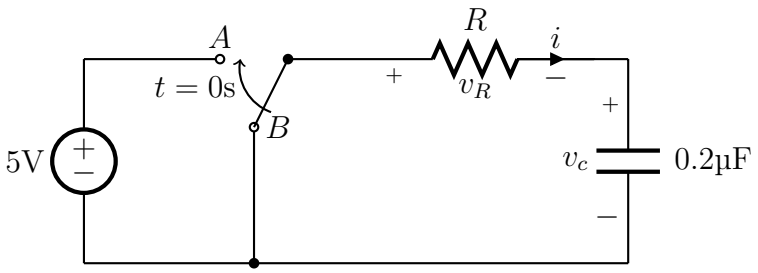
1. Consider the RC circuit shown below with a switch that moves between positions A and B.



   (a) Assume the switch has been connected to position B for a long time before it moves to position A at time $t = 0$s. For this "charging" circuit:
      i. Determine the time-constant, τ.
      ii. Using the time-constant, estimate the 10%-90% rise-time, t_r.
      iii. Write the mathematical expression for the capacitor's voltage, v_c.
      iv. Sketch v_c versus time using values at multiples of the time-constant as a guide (use at least five points).
      v. Label the rise-time on the sketch of v_c and check that your estimate of its value appears correct.
      vi. Find the mathematical expression for the resistor's voltage, v_R.
      vii. Find the mathematical expression for the current, i.
      viii. Sketch i versus time using values at multiples of the time-constant as a guide (use at least five points).

   (b) Assume the switch has been connected to position A for a long time before it moves to position B at time $t = 0$s. For this "discharging" circuit:
      i. Write the mathematical expression for the capacitor's voltage, v_c.
      ii. Sketch v_c versus time using values at multiples of the time-constant as a guide (use at least five points).
      iii. Find the mathematical expression for the resistor's voltage, v_R.
      iv. Find the mathematical expression for the current, i.
      v. Sketch i versus time using values at multiples of the time-constant as a guide (use at least five points).

2. Consider the RC circuit shown below with a switch that moves from position B to A at time $t = 0$s, i.e., this is a "charging" circuit.



Given $v_c = 0.5$V at time $t = 0.5$ms and $v_c = 4.5$V at time $t = 11.5$ms, find the following:

(a) 10%-90% rise-time, t_r, of the circuit,

(b) time-constant, τ, of the circuit,

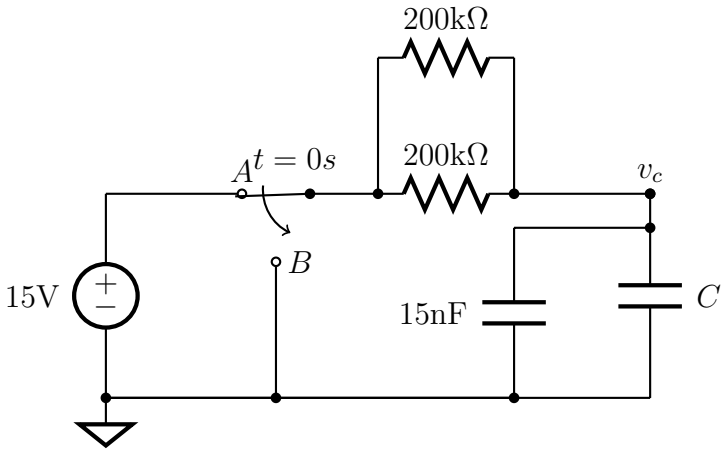
(c) value of the unknown resistor, R,

(d) mathematical expression for the capacitor's voltage, v_c,

(e) sketch of v_c versus time using values at multiples of the time-constant as a guide (use at least five points), and

(f) label rise-time on the sketch.

3. Consider the RC circuit shown below with a switch that moves from position A (after being there for a long time) to position B at time $t = 0$s, i.e., this is a "discharging" circuit.



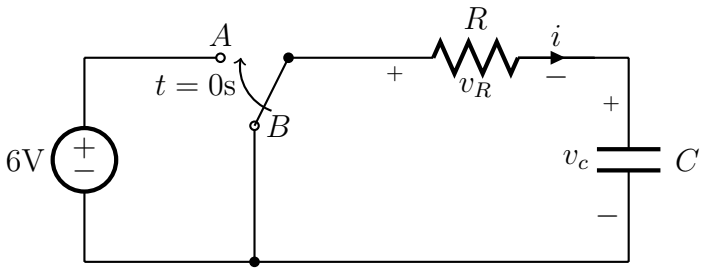
Given the circuit's time constant is $\tau = 2$ms find the following:

(a) value of the capacitor, C,

(b) mathematical expression for the voltage, v_c, and

(c) sketch of v_c versus time using values at multiples of the time-constant as a guide (use at least five points).

4. Consider the RC circuit shown below with a switch that moves from position B (after being there a long time) to position A at time $t = 0$s. Given that at time $t = 330$µs the resistor's voltage is $v_R = 2$V, determine the time constant, τ, for the circuit.



5. Consider the RC circuit shown below with a switch that moves from position A (after being there for a long time) to position B at time $t = 0$s. Given the circuit's time constant is $\tau = 7.5$µs and at a particular time after the switch has moved the current is measured to be $i = -240$µA, find the time at which the measurement was taken.