

ECE 321: Handout #4

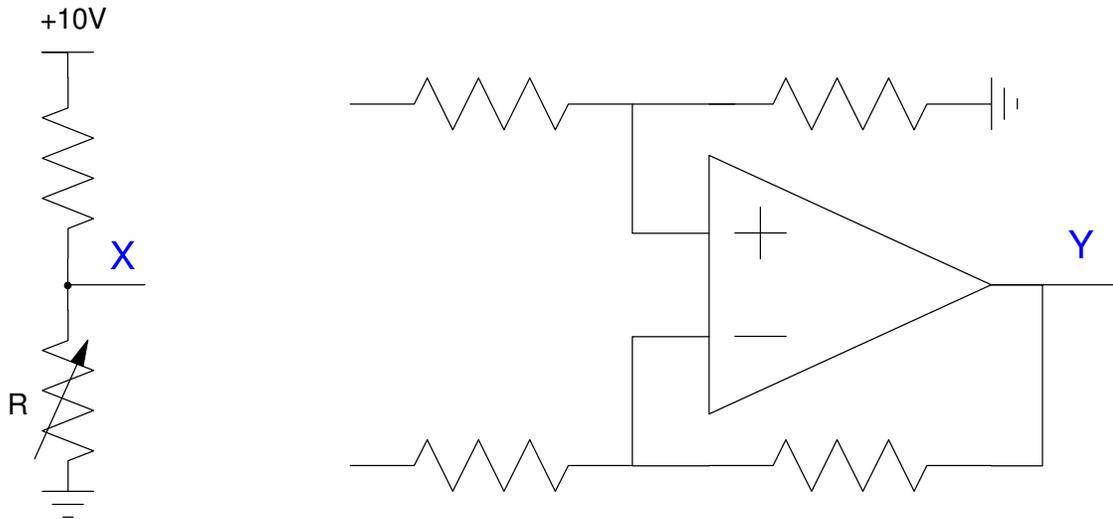
Temperature Sensors

A thermistor has a temperature - resistance relationship of

$$R = 1000 \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$$

Design a circuit which outputs

- 0V at 0C
- 10V at +40C
- Voltage is proportional to temperature for 0C < T < +40C



Solution

Assume a 1k resistor.

At 0C (Y = 0V)

- R = 3320.12 Ohms
- $X = \left(\frac{R}{R+1k}\right) 10V = 7.6853V$

At +40C (Y = 10V)

- R = 533.66 Ohms
- $X = \left(\frac{R}{R+1k}\right) 10V = 3.4797V$

The output increases as X decreases

- Connect X to the minus input

The output is 0V when X = 7.68V

- Connect 7.68V to the other input (plus)

The gain is

$$gain = \left(\frac{\text{change in Y}}{\text{change in X}}\right) = \left(\frac{10V-0V}{7.6853V-3.4797V}\right) = 2.3778$$

- The resistor ratio is 2.3778 : 1

