

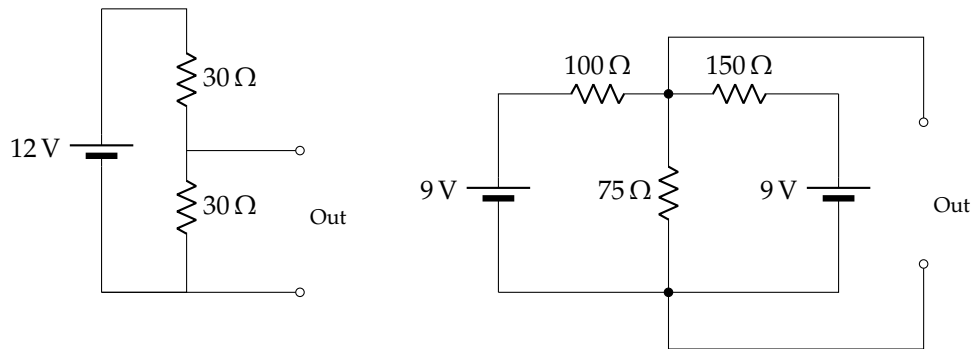
*Problem Set 2: Due Tuesday 4 March 2025
at beginning of class!*

Physics 251

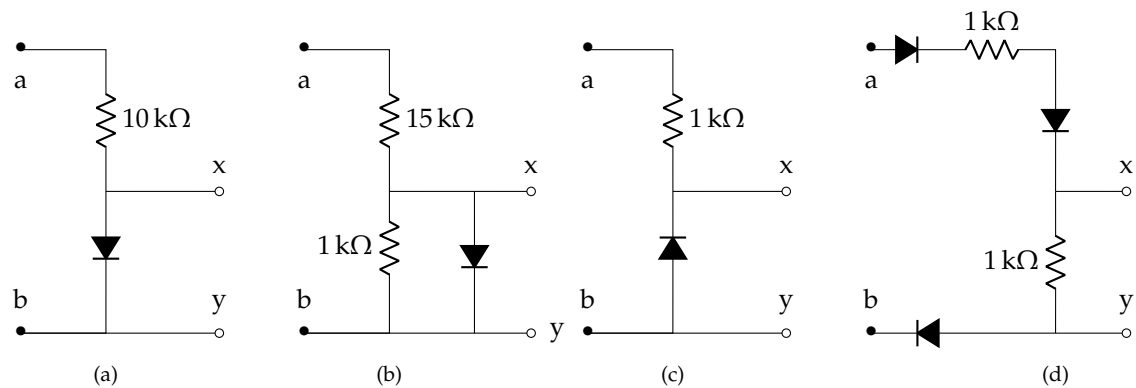
Spring 2025

These problems are designed to give you practice with Thevenin equivalents, diodes, and complex numbers, and filter circuits.

1. Find the Thevenin equivalent voltage and resistance for each of the two circuits below. Briefly explain your thinking and show any needed calculations neatly and box your answers.



2. Find the voltage between x and y when the voltage between a and b is i) 20 Volts ii) 5 Volts. Point a is positive relative to point b and all diodes can be assumed to have $V_F = 0.6$ Volts.



3. If z_1 and z_2 are two complex numbers, prove that

$$z = \frac{|z_1|}{|z_2|} = \frac{|z_1|}{|z_2|}.$$

Hint: use the polar form for z_1 and z_2 ; however, if you want to use the cartesian form, that will work too.

4. Design an RC high pass filter with a cut off frequency of 12 KHz. The filter must be able to be connected to loads of 50 K Ω or higher.
5. An AC signal is given by $V(t) = 30 \sin(3840t)$. What are the (a) peak voltage, (b) rms voltage, (c) peak to peak voltage, (d) angular frequency, (e) frequency, and (f) period?
6. A particular light emitting diode has a forward voltage drop of 1.2 Volts. It is desired to run this diode with a current of 10 mA from a 12 Volt source. Draw a circuit diagram showing how to connect the LED, a resistor, and a 12 volt battery for proper operation. Find the value of the resistor.