

Tutorial # 02

(Week:3-7 Jan 2022)

1. Suppose a voltage source has an ideal voltage of 5V and an internal resistance of 1Ω . For what values of the load resistance will the voltage source appear stiff?
2. Suppose a current source has an ideal current of 100 mA and an internal resistance of $50\text{ M}\Omega$. For what values of load resistance will the current source appear stiff?
3. The internal resistance of a voltage source equals 0.1Ω . How much voltage is dropped across this internal resistance when the current through it equals 5 A?
4. If the ideal current of a current source is 5 mA and the internal resistance is $250\text{ k}\Omega$, determine the load current flowing through the load resistor $10\text{ k}\Omega$. Is this a stiff current source?
5. Design a hypothetical current source using a battery and a resistor. The current source must meet the following specifications: It must supply a stiff 1 mA of current to any load resistance between 0 and $10\text{ k}\Omega$.
6. Somebody hands you a black box with a $2\text{ k}\Omega$ resistor connected across the exposed load terminal. How can you measure the Thevenin voltage? Now suppose the black box has a knob on it that allows you to reduce all internal voltage and current sources to zero. How can you measure the Thevenin resistance?
7. Determine the Thevenin voltage and Thevenin resistance of the given circuit in Fig. 1. What would happen when the voltage source is decreased to 12 V? Calculate the load current for the load resistance of $1\text{ k}\Omega$.

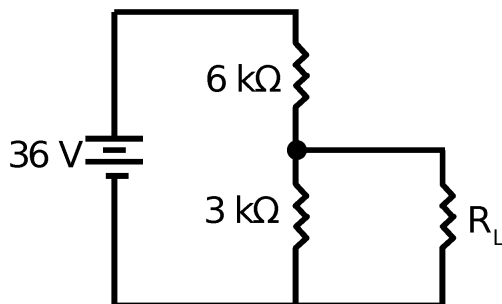


Fig. 1

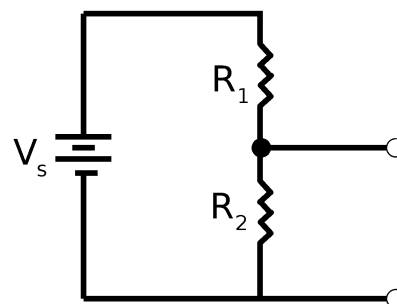


Fig. 2

8. How do you analyze the circuit of Fig. 1 using Norton's theorem?
9. Design a voltage divider (similar to the one in Fig. 2) that meets these specifications: Ideal source voltage is 30 V, open-load voltage is 15 V. Thevenin resistance is equal to or less than $2\text{ k}\Omega$.
10. Calculate the load current in Fig. 3 for each of the load resistance: 0Ω , $1\text{ k}\Omega$, $3\text{ k}\Omega$, $4\text{ k}\Omega$, $5\text{ k}\Omega$, $6\text{ k}\Omega$.

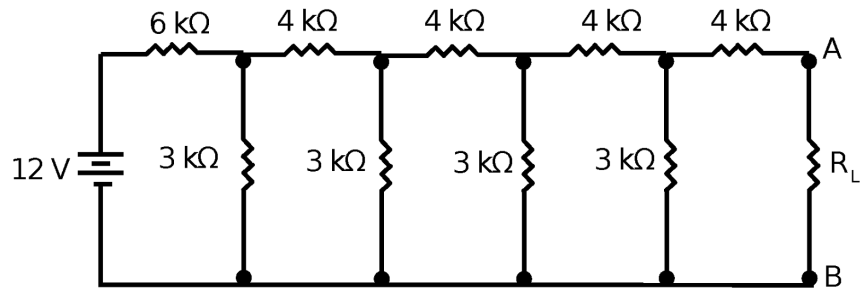


Fig. 3

11. A car battery has an open circuit terminal voltage of 12.6 V. The voltage drops to 10.8 V when the battery supplies 240 A to a starter motor. What is the Thevenin equivalent circuit for this battery?
12. Find the Thevenin equivalent circuit for a dc power supply that has a 30 V terminal voltage when delivering 400 mA and a 27 V terminal voltage when delivering 600 mA.
13. In full sunlight a $2 \times 2 \text{ cm}^2$ solar cell has a short circuit current of 80 mA and the current is 75 mA for a terminal voltage of 0.6 V. What is the Norton equivalent circuit?
14. Find the Norton equivalent circuit for the power supply of the problem 2 if the terminal voltage is 28 V instead of 27 V when the power supply delivers 600 mA.
15. What resistor draws a current of 5 A when connected across the terminals *a* and *b* of the circuit shown in the Fig. 4.

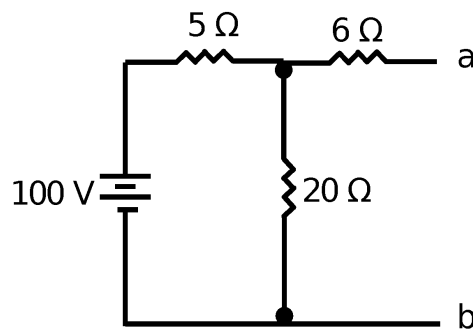


Fig. 4

16. Find the Thevenin equivalent of the circuit shown in Fig. 5.

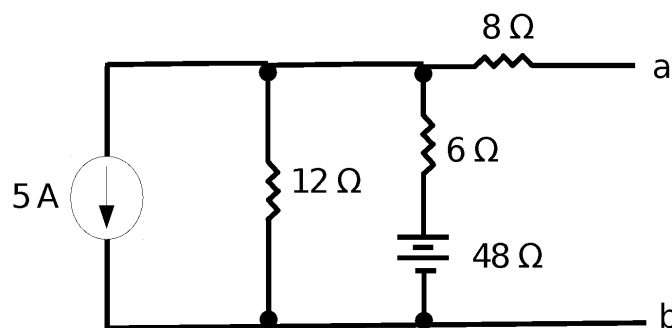


Fig. 5

17. Find the Thevenin equivalent of the circuit shown in Fig. 6.

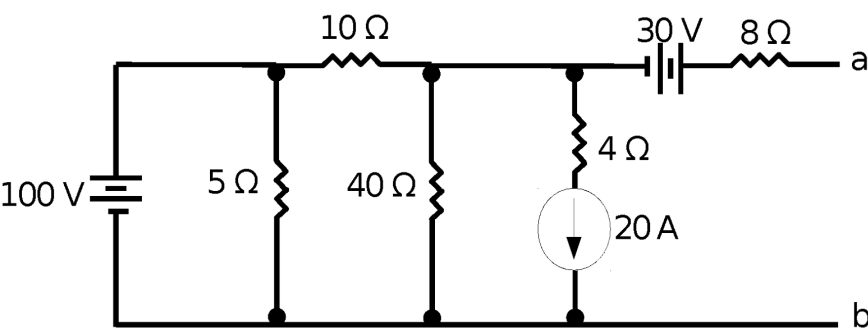


Fig. 6