Reminders 08-11-09:

- Exam 4 Average 70%
- Last Exam Thursday
- Read Chapters 22 and 23
- Answers to Standardized Test p. 589 1A, 2D, 3D, Skip the rest

Answers to Standardized Test p. 615 1A, 2D, 3C, 4D, 5C, 6B, 7C, 8D

Objectives:

- Series and Parallel Circuits
- Power
- Internal Resistance

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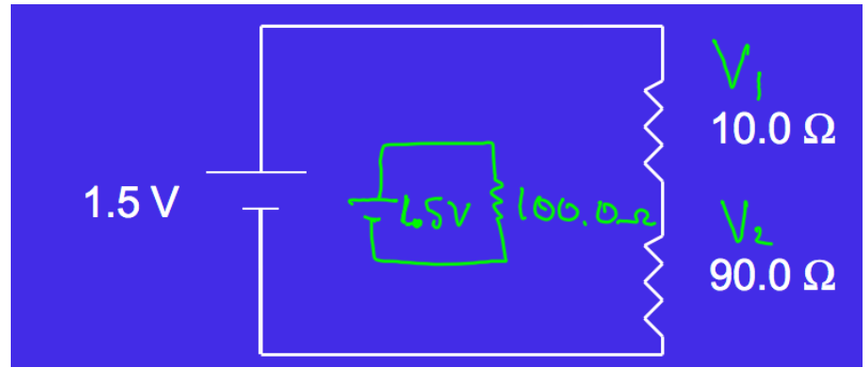

$$V_1 + V_2 = V_{battery}$$

$$IR_1 + IR_2 = V_{battery} = IR_{eq}.$$

$$\cancel{I}(R_1 + R_2) = \cancel{I} R_{eq}$$

$$R_{eq} = R_1 + R_2.$$

In above circuit

$$R_{eq} = 100.0\,\Omega$$

$$V_{BATTERY} = IR_{eq}$$

$$I = \frac{V_{battery}}{R_{eq}} = \frac{1.5V}{100.0\,\Omega}$$

$$= .015A$$

$$= 15mA$$

$$V_1 = (.015A)(10.0\,\Omega) = 0.15V$$

$$V_2 = (.015A)(90.0\,\Omega) = \underline{1.35V}$$

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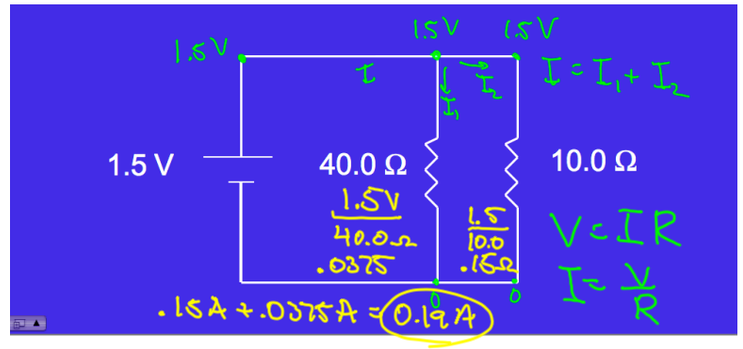

$$I = I_1 + I_2$$

$$\frac{\cancel{V_{battery}}}{R_{eq}} = \frac{\cancel{V_{battery}}}{R_1} + \frac{\cancel{V_{battery}}}{R_2}$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_{eq}^{-1} = R_1^{-1} + R_2^{-1}$$

$$R_{eq} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

For above circuit

$$\frac{1}{R_{eq}} = \frac{1}{10.0\,\Omega} + \frac{1}{40.0\,\Omega}$$

$$= \frac{4}{40.0\,\Omega} + \frac{1}{40.0\,\Omega} = \frac{5}{40.0\,\Omega}$$

$$\frac{1}{R_{eq}} = \frac{5}{40.0\,\Omega}$$

$$R_{eq} = 8.00\,\Omega$$

$$I_T = \frac{1.5\,V}{8.00\,\Omega} = 0.19\,A$$

- A 60 W light bulb is rated at 120 V. How much current must pass through the bulb to dissipate energy at this rate? What is the resistance of the bulb? What happens as it heats up?

$$P = VI$$

$$I = \frac{P}{V} = \frac{60\,W}{120\,V} = \underline{0.50\,A}$$

$$V = IR \qquad R = \frac{V}{I} = \frac{120\,V}{0.5\,A}$$

$$= 240\,\Omega$$

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$$P = VI$$

$$V = IR$$

$$I = \frac{V}{R}$$

$$P = V\left(\frac{V}{R}\right) = \frac{V^2}{R}$$

$$P = I^2R$$

$$R = \frac{V^2}{P}$$

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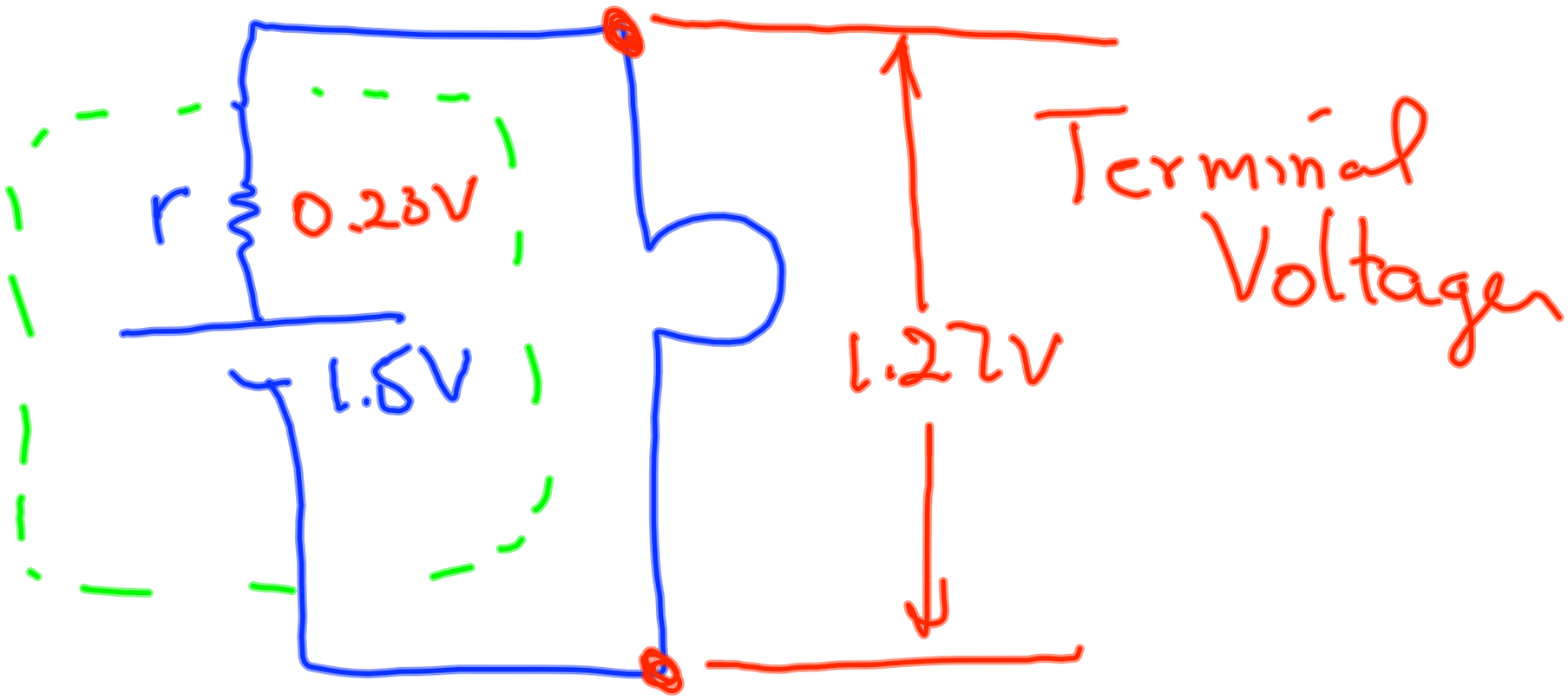

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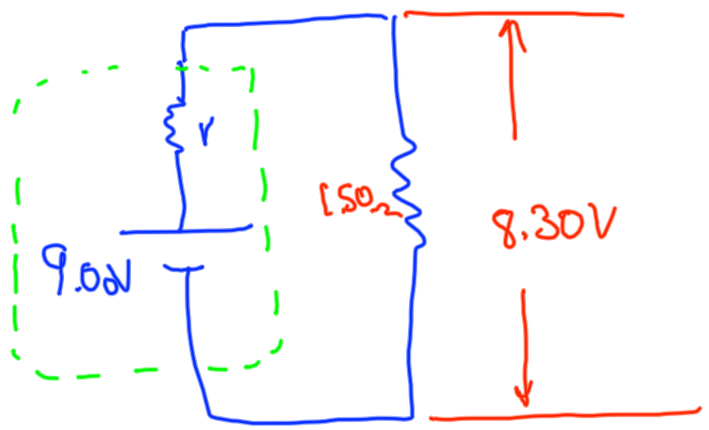
- A 1.50 Ω resistor is connected across a 9.00 V battery. The voltage between the terminals of the battery is observed to be 8.30 V. Find the current in the circuit and the internal resistance of the battery.



$V_r = 9.00V - 8.30V = 0.70V$

$I = \frac{V}{R} = \frac{8.30V}{1.50\Omega} = 5.50A$

find r. Know $V_r = 0.70V$

$I = 5.50A$

$V = IR$

$r = \frac{V}{I} = \frac{0.70V}{5.50A} = 0.13\Omega$

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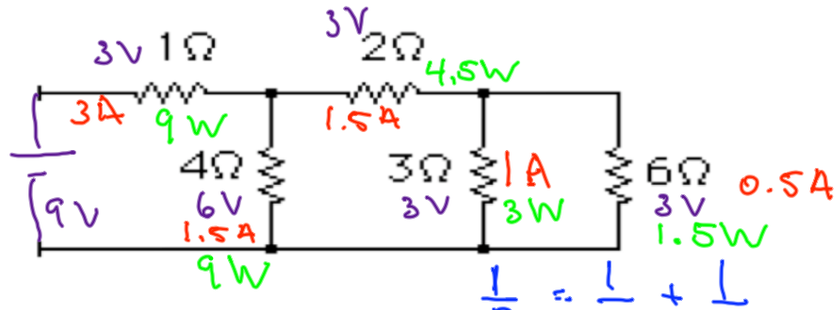
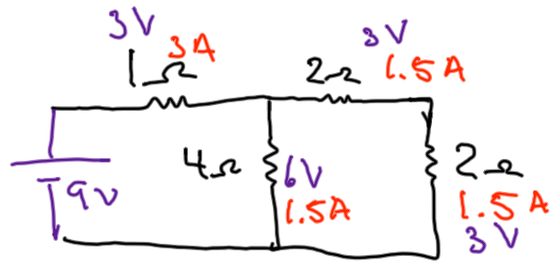
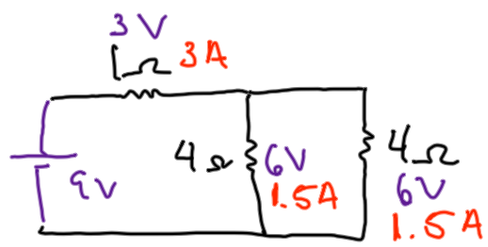


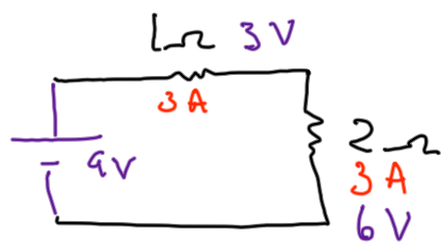
$$\frac{1}{R_{eq}} = \frac{1}{3\Omega} + \frac{1}{6\Omega}$$

$$= \frac{2}{6\Omega} + \frac{1}{6\Omega} = \frac{3}{6\Omega}$$

$$R_{eq} = 2\Omega$$







- A battery is designed to deliver 31 A for 2.0 hrs. before becoming totally discharged.
  - How many coulombs of charge can it deliver?
  - What is the corresponding number of electrons?
  - If a battery charger delivers 2.0 A of current, how long will it take to recharge the battery?

$$I = \frac{\Delta Q}{\Delta t} \Rightarrow \Delta Q = I\Delta t$$

$$\Delta Q = (31\,A)(2.0\,hrs)\left(3600\,\frac{s}{hr}\right)$$

$$= 2.2 \times 10^5\,C$$

$$\frac{2.2 \times 10^5\,C}{1.602 \times 10^{-19}\,C/electron} = 1.4 \times 10^{24}\ electrons$$

$$(31)(2.0)\left(3600\,\frac{s}{hr}\right) = (x)(2.0\,A)(3600)$$

$$x = 31\,hrs$$

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- A 120 V toaster is rated at 1350 W. A 120 V microwave oven is rated at 1100 W. The two are connected into an outlet than has a maximum current rating of 20.0 A. Will a fuse blow if the two items are connected to the outlet simultaneously?

$P = VI \qquad I = \frac{P}{V}$

$I_{TOASTER} = \frac{1350\,W}{120\,V} = 11\,A$

$I_{M\text{-}WAVE} = \frac{1100\,W}{120\,V} = 9.2\,A$

$I_{TOTAL} = 11\,A + 9.2\,A = \underline{20.2\,A}$

Fuse blows

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- A 75 W light bulb is rated at 120 V. How much energy is required to keep this bulb lit for 1 hour? If the power company charges 10 cents per kilowatt-hour how much will it cost?

$$\text{Power} = \frac{\text{Energy}}{\text{Time}}$$

$$\text{Energy} = (\text{Power})(\text{time})$$

$$= \left(75\ \frac{J}{s}\right)(3600\ s/hr)$$

$$= 2.7 \times 10^5\ J$$

How many Joules are there in 1 Kw-hr

$$(1000\ s)(1\ hr)\left(3600\ \frac{s}{hr}\right)$$

$$= 3.6 \times 10^6\ J/Kw\text{-}hr$$

Kw-hr used by bulb

$$\frac{2.70 \times 10^5\ J}{3.6 \times 10^6\ J/Kw\text{-}hr} = .075\ Kw\text{-}hr$$

total cost $0.075\ Kw\text{-}hr \cdot (10¢/Kw\text{-}hr)$

$$= 0.75¢$$