

Circuits Review

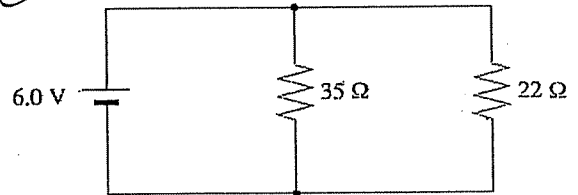
1. In an electric circuit, 6.25×10^{18} electrons flow past one point in 0.10 s. What is the current?

$I = \frac{Q}{t}$, $Q = n \cdot e^-$
 $= (6.25 \times 10^{18})(1.6 \times 10^{-19} \text{ C}) = 1 \text{ C}$

$I = \frac{1 \text{ C}}{0.10 \text{ s}} = 10 \text{ A}$

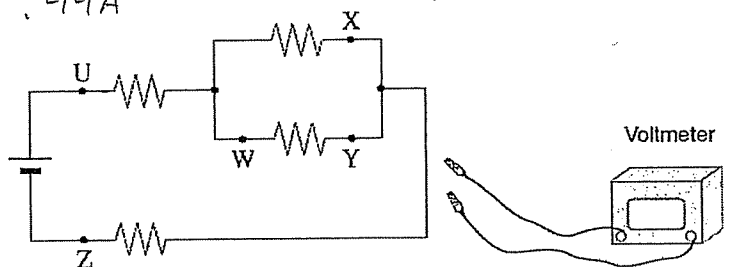
2. What current would be drawn from the power supply in the circuit shown below?

$\frac{1}{R} = \frac{1}{35} + \frac{1}{22} = .0740$, $R = 13.5 \Omega$
 $I = \frac{V}{R} = \frac{6 \text{ V}}{13.5 \Omega} = .44 \text{ A}$



3. A student needs to connect a voltmeter to measure the potential difference across the parallel resistors in the circuit shown right. Across which two connection points should the student connect the voltmeter?

W Y

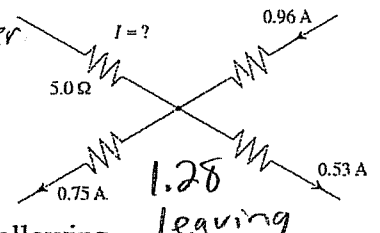


4. A circuit junction is shown below.

What is the current and its direction through the 5.0Ω resistor?

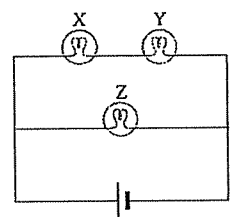
	CURRENT	DIRECTION
A.	0.32 A	away from junction
B.	0.32 A	towards the junction
C.	2.24 A	away from junction
D.	2.24 A	towards the junction

1.28 leaving 5.0
 1.28 must enter
 .32A towards



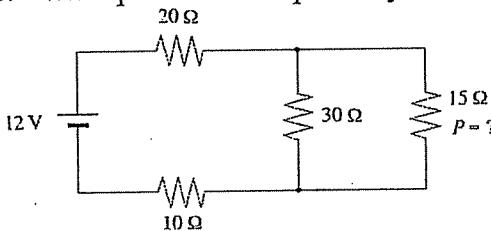
5. Three identical light bulbs are placed in a circuit as shown. Which of the following is correct?

- A. The voltage and current are the same for all three bulbs.
- B. The current in light bulb Z is less than the current in light bulb X.
- C. The current in light bulb Z is greater than the current in light bulb Y.
- D. The voltage across light bulb Z is less than the voltage across light bulb X.



XY has more resistance so less current

6. What power is dissipated by the 15Ω resistor in the circuit shown?



20Ω loss, $V = (0.3)(20) = 6 \text{ V}$

10Ω loss, $V = 3 \text{ V}$

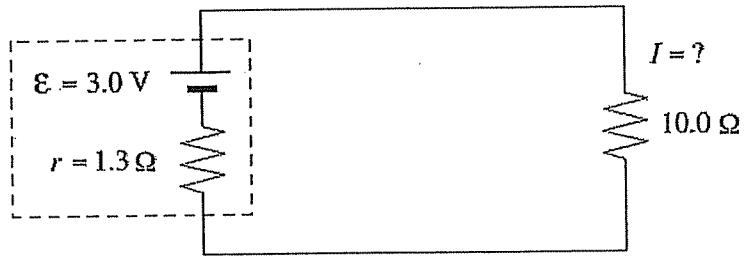
so 15Ω loss $V = 12 - 6 - 3 \text{ V} = 3 \text{ V}$

$\frac{1}{R_{11}} = \frac{1}{30} + \frac{1}{15}$ $R = 10 \Omega$

$R_T = 40 \Omega$ so $I = \frac{V}{R} = \frac{12}{40} = 0.3 \text{ A}$

$P = \frac{V^2}{R} = \frac{3^2}{15} = .6 \text{ W}$

7. What is the current I through the 10.0Ω resistor in the circuit shown?

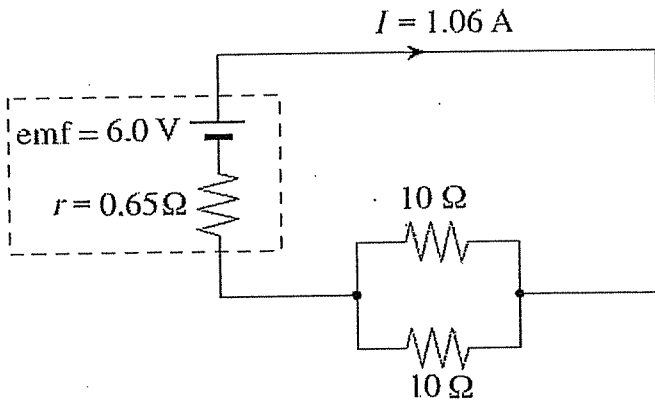


$$R_T = 11.3 \Omega$$

$$I_T = \frac{V}{R} = \frac{3}{11.3} = .265 \text{ A}$$

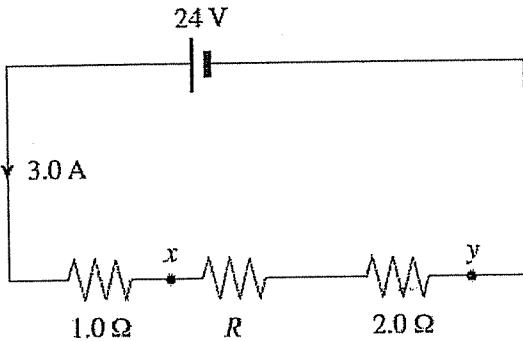
↑
Same as thru 10Ω

8. What is the terminal voltage of the battery in the circuit shown?



$$\begin{aligned} V_T &= \mathcal{E} - Ir \\ &= 6.0 \text{ V} - (1.06)(.65) \\ &= 5.3 \text{ V} \end{aligned}$$

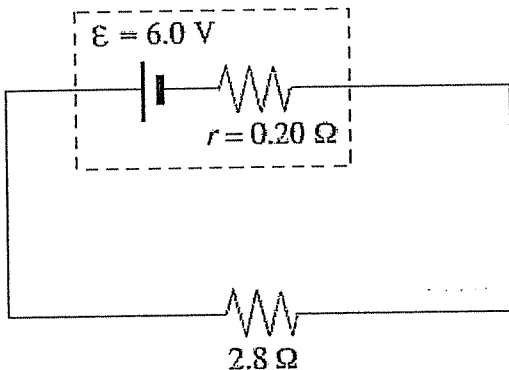
9. A series circuit consists of a battery and three resistors arranged as shown in the diagram below. What is the potential difference V_{xy} ?



3V lost across 10Ω , so

21V must be lost across rest to equal 24V

10. What is the battery's terminal voltage in the circuit below?



$$R_T = 3.0 \Omega$$

$$\begin{aligned} I_T &= \frac{V}{R} = \frac{6.0 \text{ V}}{3.0} \\ &= 2 \text{ A} \end{aligned}$$

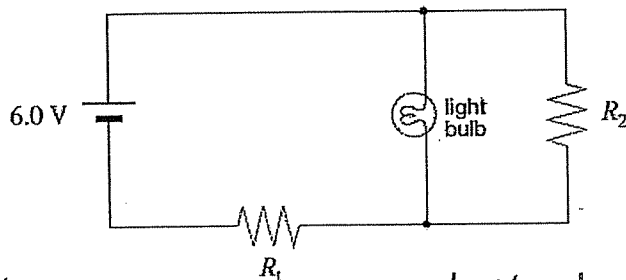
$$\begin{aligned} V_T &= \mathcal{E} - Ir \\ &= 6 - (2 \text{ A})(.2 \Omega) = 5.6 \text{ V} \end{aligned}$$

11. A student is instructed to determine the amount of charge flowing past a point in a circuit of unknown resistance during an experiment. What equipment will permit the student to do this?

- A. voltmeter
 B. ammeter, voltmeter
 C. ammeter, stopwatch
 D. voltmeter, stopwatch

$$I = \frac{Q}{t}, Q = I \cdot t$$

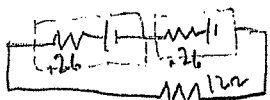
12. A student initially sets up a circuit containing two resistors and a light bulb, as shown. The student notes the brightness of the light bulb. Using principles of physics, explain what happens to the brightness of the light bulb when resistor R_2 is removed.



although R_T increases and I_T

decreases it does not have to split, so more current thru bulb = brighter

13. A flashlight contains two batteries in series with a bulb of resistance 12Ω . Each battery has an emf of 1.5 V and an internal resistance of 0.26Ω . What is the potential difference across the bulb?

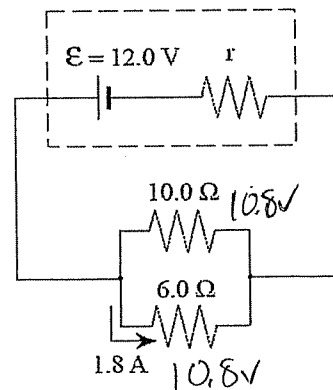


$$R_T = 12.52 \Omega, I_T = .24 \text{ A}, V = IR = (.24)(12) = 2.88 \text{ V}$$

14. A 12 V battery is connected to a 20Ω resistor. How much charge flows through the battery in 3.5 s ?

$$Q = I \cdot t, I = \frac{V}{R} = \frac{12}{20} = .6 \text{ A}, Q = (.6)(3.5) = 2.1 \text{ C}$$

15. A battery with an emf of 12.0 V and an internal resistance r is connected to a circuit as shown. If the current through the 6.0Ω resistor is 1.8 A , what is the internal resistance r ?



$$I_{10} = 1.08 \text{ A}, V_r = 12 - 10.8 = 1.2 \text{ V}$$

$$I_T = 2.88 \text{ A}, R = \frac{V}{I} = \frac{1.2 \text{ V}}{2.88} = .42 \Omega$$

16. Which of the following relationships correctly applies to the circuit shown?

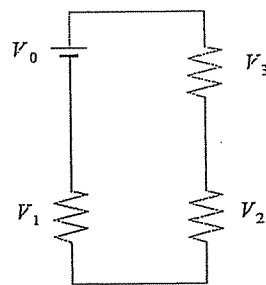
(A) $V_0 = V_1 + V_2 + V_3$

B. $V_0 + V_1 = V_2 + V_3$

C. $V_0 = V_1 = V_2 = V_3$

D. $\frac{1}{V_0} = \frac{1}{V_1} + \frac{1}{V_2} + \frac{1}{V_3}$

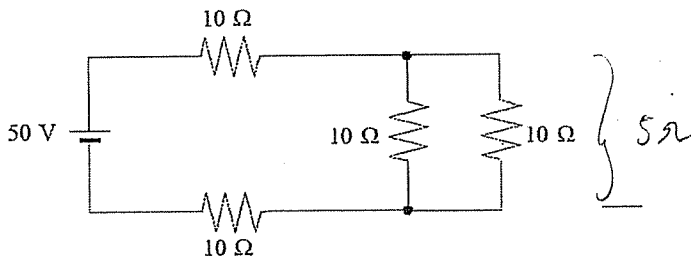
$V_{\text{increase}} = V_{\text{decrease}}$



17. In the following circuit, what current is drawn from the battery?

$$R_T = 25 \Omega$$

$$I = \frac{V}{R} = \frac{50}{25} = 2 \text{ A}$$



18. In the following circuit, what is the power loss in the battery due to its internal resistance?

different ways to do this $P = V \cdot I, I^2 R$

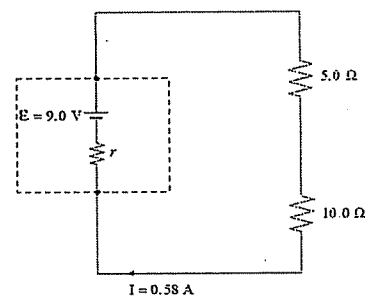
$$P_{\text{battery}} = (1.58)(9.0) = 5.22 \text{ W}$$

$$P_{5\Omega} = (1.58)^2(5) = 1.68 \text{ W}$$

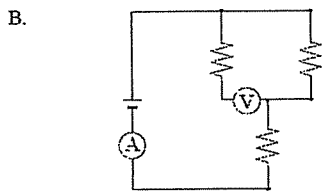
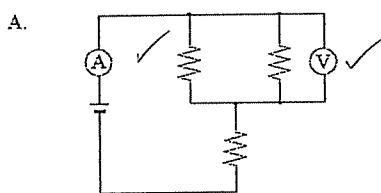
$$P_{10\Omega} = (1.58)^2(10) = 3.36 \text{ W}$$

5.04 W used

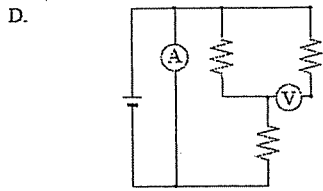
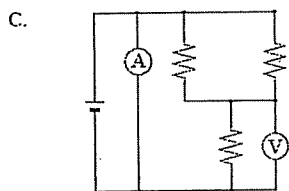
$P = .18 \text{ W}$ difference.



19. Which of the following shows the correct placement of an ammeter and a voltmeter in the circuit?



(V) in parallel
(I) in series



20. A 75 W bulb is connected across a 120 V source. While the bulb is lighted, what is the effective resistance of the bulb?

- A. 0.62 Ω
- B. 1.6 Ω
- C. 47 Ω
- D. 190 Ω

$$P = \frac{V^2}{R}, R = \frac{V^2}{P} = \frac{120^2}{75} = 192 \Omega$$

21. A 9.0 V battery with an internal resistance of 0.80 Ω is connected to two resistors as shown. Determine the terminal voltage V_{ab} of the battery.

$$R_{11} = 6 \Omega$$

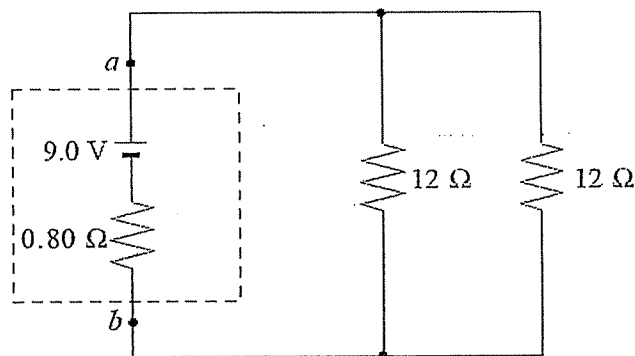
$$R_T = 6.8 \Omega$$

$$I_T = \frac{V}{R} = \frac{9.0}{6.8} = 1.32 \text{ A}$$

$$V_T = \mathcal{E} - I r$$

$$= 9.0 \text{ V} - (1.32 \text{ A})(0.8 \Omega)$$

$$= 7.94 \text{ V}$$



Answers: 1) 10 A, 2) 0.44A, 3) W&X or W&Y, 4) B, 5) C, 6) 0.6 W, 7) 0.265 A, 8) 5.3 V, 9) 21 V, 10) 5.6 V, 11) C, 12) brighter 13) 2.875 V, 14) 2.1 C, 15) 0.42 Ω, 16) A, 17) 2.0 A, 18) 0.175 W, 19) A, 20) D, 21) 7.94 V