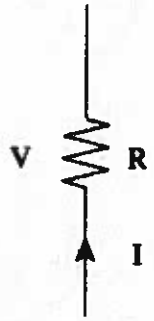
KEY

PHYSICS 11

CIRCUIT ELECTRICITY

1.

Consider the circuit element shown below.



The voltage across the resistor increases from V to 2V. The resistance remains the same. By what factor has the current changed?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 2

D. 4

$R_1 = R_2$

$V_2 = 2 \cdot V_1$

$I_2 = ? \cdot I_1$

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

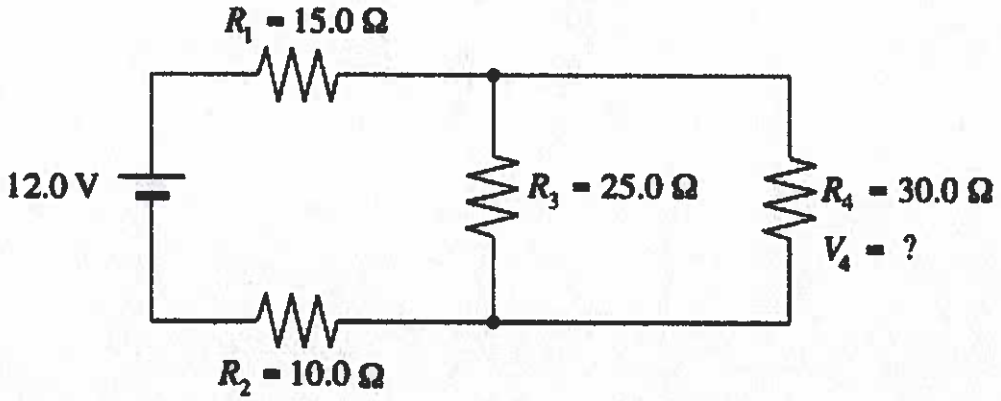
$$I_1 = \frac{V_1}{R_1}$$

$$I_2 = \frac{V_2}{R_2} = \frac{2V_1}{R_1} = 2 \cdot \frac{V_1}{R_1} = 2 \cdot I_1$$

∴ The current changed by a factor of 2

2.

A 12.0 V power supply is connected to 4 resistors as shown.



What is the potential difference, V_4, across the 30.0 Ω resistor?

A. 2.12 V
B. 4.24 V
C. 9.32 V
D. 12.0 V

$V_4 = V_3 = 12 - V_2 - V_1$

- $R_{eq} = 15.0 + 10.0 + \dfrac{1}{\frac{1}{25} + \frac{1}{30}}$

$\doteq 38.64\ \Omega$

- $I_{TOT} = \dfrac{V_B}{R_{eq}} = \dfrac{12.0}{38.64} \doteq 0.31\ A$ $\quad I_{TOT} = I_1 = I_2$

$V_{loop} = V_3 = V_4$

- $I_{TOT} = I_4 + I_3$

- $V_1 = I_1 R_1$
  $= (0.31)(15)$
  $= 4.65\ V$

- $V_2 = I_2 R_2$
  $= (0.31)(10)$
  $= 3.1\ V$

- $V_4 = 12 - (4.65 + 3.1)$
  $= 4.25\ V$
  ↑ Some rounding error

3.

An electric motor is being supplied with 500 W of power at 120 V. The resistance of the motor is 8.0 Ω. What current is being supplied to the motor?

A. 4.2 A
B. 7.9 A
C. 15 A
D. 63 A

$P = IV$

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

$= \frac{500}{120}$

$\doteq 4.2$ A

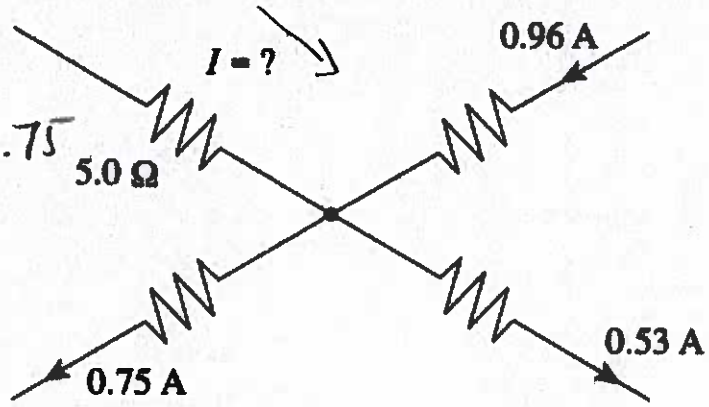
4.

A circuit junction is shown below.

$I_{in} = I_{out}$

$0.96 + x = 0.53 + 0.75$

$x = 0.32$ A



What is the current and its direction through the 5.0 Ω 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

* I must flow into the junction as $0.75 + 0.53 = 1.28$A flows out and only 0.96A flows in

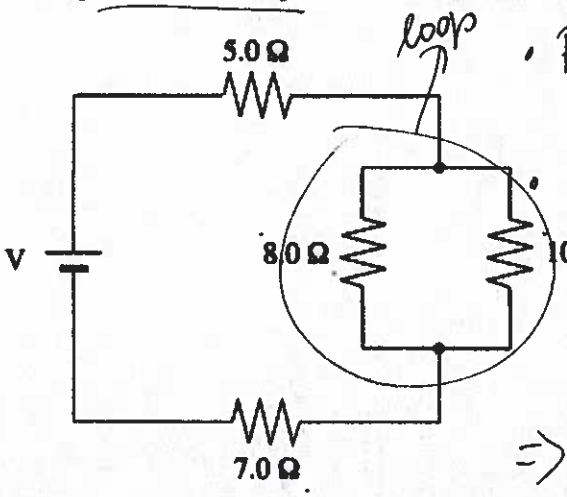
5.

A power source is providing a constant voltage, V, to the circuit shown below.

$R_{eq} = 5 + 7 + \frac{1}{\frac{1}{8} + \frac{1}{10}}$

$= 16.4\ \Omega$

$R_{eq} \uparrow$



loop

- $R = 8\ \Omega$ is in parallel with $R = 10\ \Omega$
- Removing $R = 8\ \Omega$ will increase the resistance in the loop.

$\Rightarrow R_{eq} = 5 + 7 + 10 = 22\ \Omega$

If the 8.0 Ω resistor is removed from the circuit what happens to the equivalent resistance of the circuit and the current through the 7.0 Ω resistor?

	Equivalent Resistance of the Circuit	Current through 7.0 Ω Resistor
A.	Increases ✓	Decreases ✓
B.	Decreases	Increases
C.	Increases ✓	Increases
D.	Decreases	Decreases

$I_{TOT} = I_7$

$I = \frac{V_B}{R_{eq}}$

as $R_{eq} \uparrow$ $I \downarrow$

Note: R and I are inversely proportional, while V and I and V and R are directly proportional.

6.

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

A. 1.6×10^{-19} A

B. 1.0 A

C. 10 A

D. 6.25×10^{19} A

$I = \frac{q}{\Delta t}$

$I = \frac{1.0}{0.10}$

$I = 10\ A$

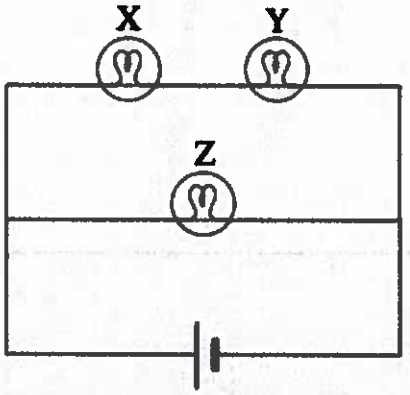
$q = (6.25 \times 10^{18})(1.6 \times 10^{-19})$

$q = 1.00\ C$

7.

Three identical light bulbs are placed in a circuit as shown.

- $R_X = R_Y = R_Z$
- $R_{branch\ 1} = R_X + R_Y$
- $R_{branch\ 2} = R_Z = \frac{1}{2} R_{branch\ 1}$



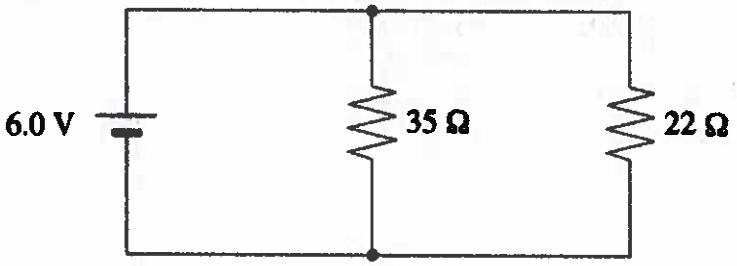
→ less R more I in branch 2

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.

8.

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



A. 0.11 A
B. 0.17 A
C. 0.27 A
D. 0.44 A

- $R_{eq} = ?$

$$\frac{1}{R_{eq}} = \frac{1}{35} + \frac{1}{22}$$

$$R_{eq} = 13.5152$$

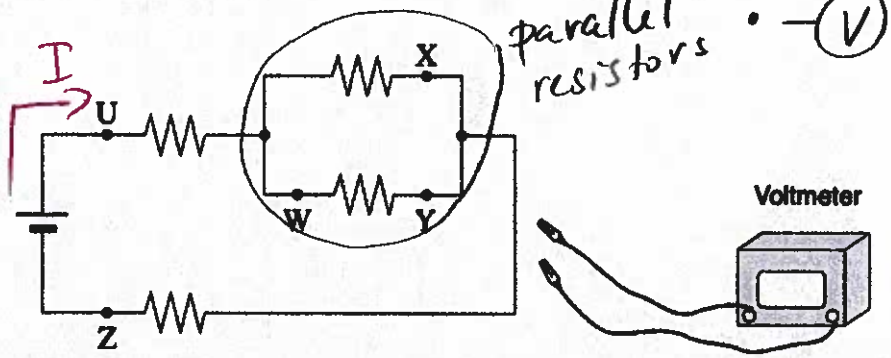
- $I = \frac{V_B}{R_{eq}}$

$$= \frac{6.0}{13.51}$$

$$= 0.44\ A$$

9.

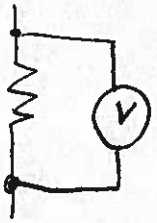
A student needs to connect a voltmeter to measure the potential difference across the parallel resistors in the circuit shown below.



parallel resistors • —(V)— connects in parrallel

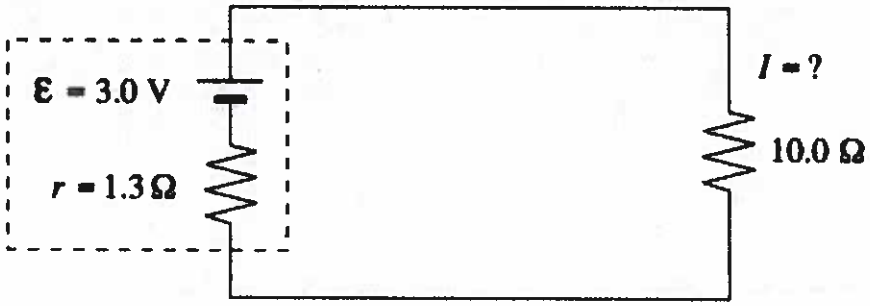
Across which two connection points should the student connect the voltmeter?

A. U and Z ✗
B. X and Y
C. X and W
D. W and Z ✗



10.

What is the current *I* through the 10.0 Ω resistor in the circuit shown below?



A. 0.27 A
B. 0.30 A
C. 0.34 A
D. 2.3 A

$$I_{10} = I_{tot} = \frac{\mathcal{E}}{R_{eq}}$$

$$= \frac{3.0}{1.3 + 10}$$

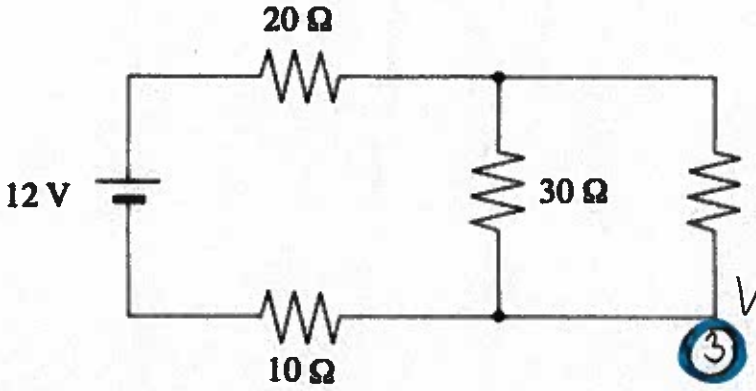
$$= 0.27 \text{ A}$$

(4) $I_{15} = \frac{V_{15}}{R} = \frac{3.0}{15} = 0.2\,A$

11.

. **What power is dissipated by the 15 Ω resistor in the circuit shown?** . $P = VI$

(5) $P = (3.0)(0.2)$
$= 0.6\,W$



(3) $V_{15} = V_{loop} = V_B - V_{20} - V_{10}$
$= 12 - (20)(0.3) - (10)(0.3)$
$= 3.0\,V$

A. 0.60 W
B. 1.4 W
C. 6.7 W
D. 15 W

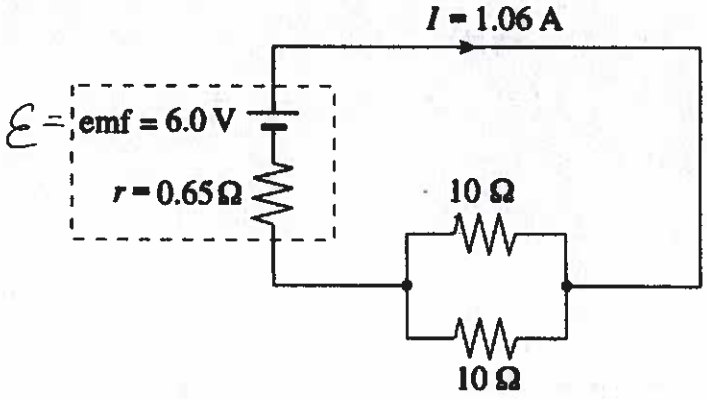
. $I_{15} = ?$

(2) . $I_{TOT} = \frac{V_B}{R_{eq}} = \frac{12}{40} = 0.30\,A$

(1) . $R_{eq} = 20 + 10 + \frac{1}{\frac{1}{30} + \frac{1}{15}} = 40\,\Omega$

12.

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



$V_{term} = \mathcal{E} - Ir$
$= 6.0 - (1.06)(0.65)$
$= 5.311\,V$

A. 0.69 V
B. 5.3 V
C. 6.0 V
D. 6.7 V