KEY

PHYSICS 11

ELECTRIC CIRCUITS 4

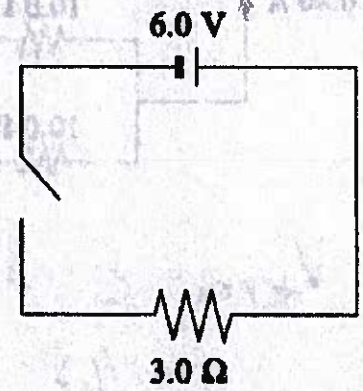
1.

A 6.0 V battery is connected through a switch to a 3.0 Ω resistor as shown below.

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

$= \frac{6.0}{3.0}$

$= 2.0\ A$



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

$q = I\Delta t$

$= (2.0)(40)$

$= 80\ C$

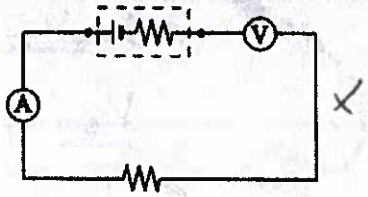
What total charge flows through the resistor if the switch is closed for 40 s ?

A. 2.0×10^{-9} C
B. 2.0 C
C. 80 C
D. 480 C

2.

Which of the following diagrams shows meters correctly placed to measure the circuit current and the terminal voltage of the battery?

A.



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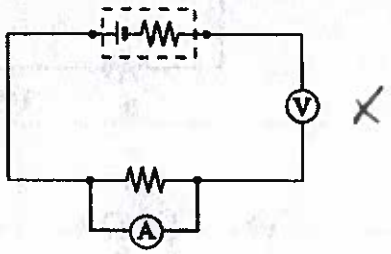
B.



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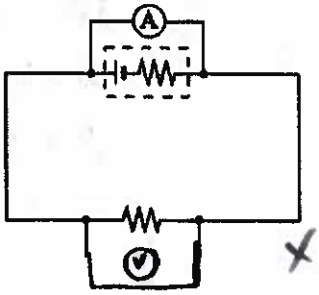
C.



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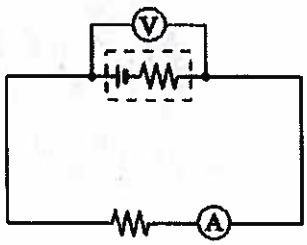
D.



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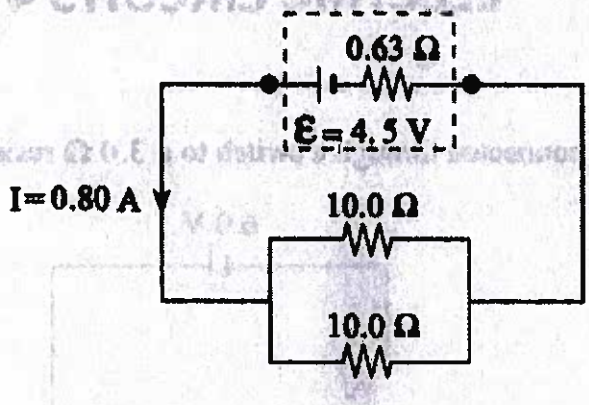
3.

. What is the terminal voltage of the cell in the circuit shown in the diagram below?



$r = 0.63\Omega$

A. 0.50 V
B. 3.5 V
C. 4.0 V
D. 4.5 V

$V_{term} = \mathcal{E} - Ir$

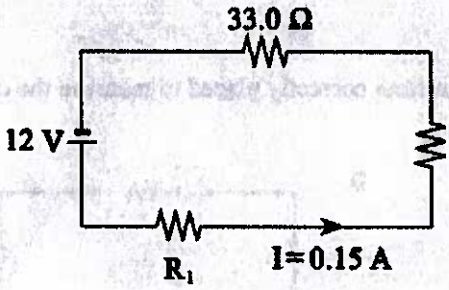
$= 4.5 - (0.8)(0.63)$

$= 3.996\ V$

$\doteq 4.0V$

4.

What is the power dissipated in resistor R_1 in the circuit shown in the diagram below?



$R_1 = R_{eq} - 33 - 10$

$= 80 - 33 - 10$

$= 37\Omega$

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

$= \frac{12}{0.15}$

$= 80\Omega$

A. 0.83 W
B. 0.97 W
C. 1.8 W
D. 2.8 W

$P = I^2R$

$= (0.15)^2(37)$

$= 0.8325\ W$

$R_{eq} = ?$

$$\frac{1}{R_{eq}} = \frac{1}{11} + \frac{1}{\frac{1}{\frac{1}{33}+\frac{1}{67}}} = 0.136$$

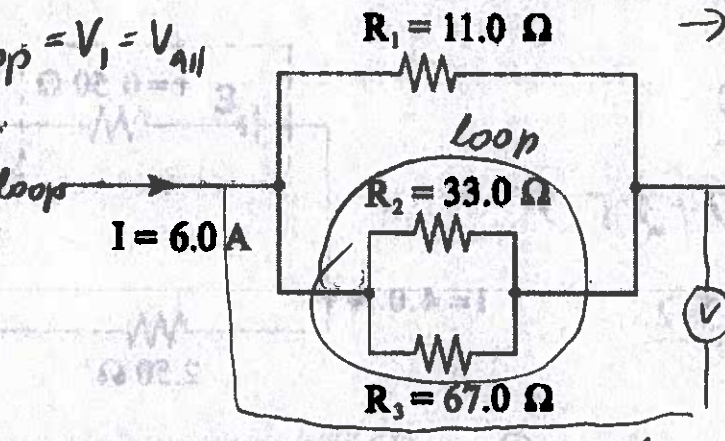
5.

The diagram below shows part of an electrical circuit.

$V_2 = V_3 = V_{loop} = V_1 = V_{all}$

$I_{TOT} = I_1 + I_{loop}$

$I_{loop} = I_2 + I_3$



$\rightarrow$ $R_{eq} = \frac{1}{0.136} = 7.346\ \Omega$

$V_{all} = I R_{eq}$
$= (6.0)(7.346)$
$= 44.076\ V$

What is the current through resistor R_1?

$I_1 = \frac{V_1}{R_1}$
$= \frac{44.076}{11}$
$= 4.00\ A$

A. 2.0 A
B. 3.0 A
C. 4.0 A
D. 6.0 A

6.

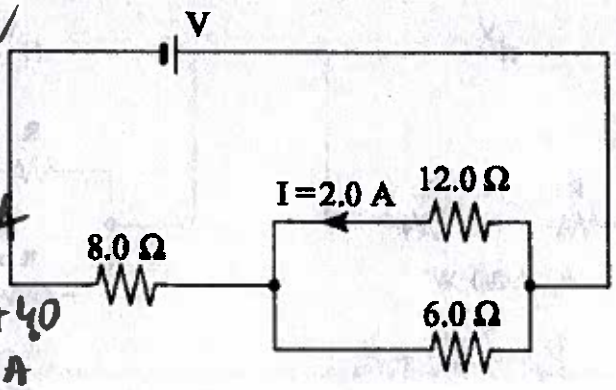
What is the voltage, V, of the power supply shown in the circuit?

$V_{loop} = V_{12} + V_6$

$V_{12} = IR$
$= (2.0)(12)$
$= 24\ V$

$V_6 = 24\ V$
$I_6 = \frac{24}{6}$
$= 4.0\ A$

$I_8 = 2.0 + 4.0$
$= 6.0\ A$



$\frac{1}{R_{loop}} = \frac{1}{12} + \frac{1}{6.0}$

$\frac{1}{R_{loop}} = \frac{1+2}{12}$

$R_{loop} = \frac{12}{3} = 4\ \Omega$

$R_{eq} = 8.0 + R_{loop}$
$= 8.0 + 4.0$
$= 12.0\ \Omega$

$V_8 = I_8 R_8$
$= (6.0)(8.0)$
$= 48\ V$

$V_B = V_8 + V_{loop}$
$= 48 + 24$
$= 72\ V$

A. 24 V
B. 52 V
C. 72 V
D. 96 V

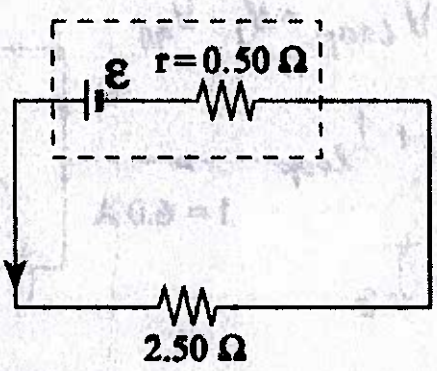
7.

What is the emf of the battery shown?

$R_{eq} = r + R$

$= 0.50 + 2.50$

$= 3.0\ \Omega$



A. 2.0 V
B. 8.0 V
C. 10 V
D. 12 V

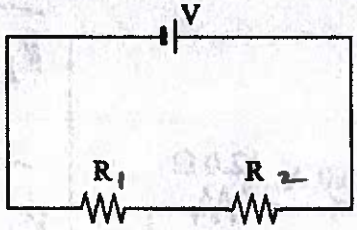
$\mathcal{E} = I R_{eq}$

$= (4.0)(3.0)$

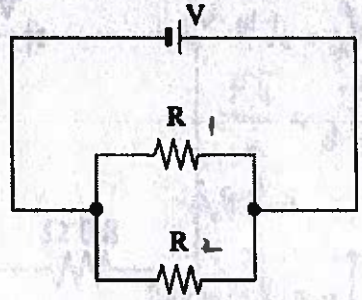
$= 12.0\ V$

8.

L4 **Two identical resistors connected in series have a total power output of 400 W. Assuming V and R remain constant, what would the total power output be when the resistors are re-connected in parallel?**



$P_T = 400$ W



$R_1 = R_2$

$I_1 = I_2 = I_{TOT}$

A. 200 W
B. 400 W
C. 800 W
D. 1 600 W

$P_T = P_1 + P_2$

$400 = I_{TOT}^2 R_1 + I_{TOT}^2 R_2$

$\frac{400}{2} = \frac{2 I^2 R}{2}$

$200 = I_{TOT}^2 R$

$200 = \left(\frac{V}{2R}\right)^2 \cdot R$

$200 = \frac{V^2}{4R} \cdot R = \frac{V^2}{4R}$

$R_{eq} = 2R$

$I_{TOT} = \frac{V}{2R}$

$800 = \frac{V^2}{R}$

$P_{TOT} = 2\frac{V^2}{R}$

$= 2(800)$

$= 1600$ W

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

$\frac{1}{R_{eq}} = 2 \cdot \frac{1}{R}$

$= \frac{2}{R}$

$I_1 = I_2 = \frac{1}{2} I_{TOT}$

$R_{eq} = \frac{R}{2}$

$I_{TOT} = \frac{V}{R_{eq}} = \frac{V}{\frac{R}{2}} = \frac{2V}{R}$

$I_1 = \frac{1}{2}\frac{2V}{R} = \frac{V}{R}$

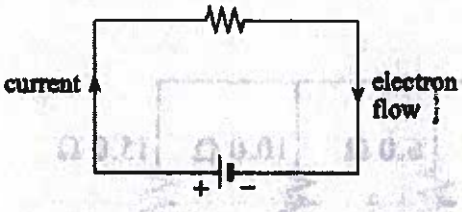
$P_1 = P_2 = \left(\frac{V}{R}\right)^2 R = \frac{V^2}{R^2} \cdot R = \frac{V}{R}$

$P_{TOT} = P_1 + P_2 = \frac{V^2}{R} + \frac{V^2}{R}$

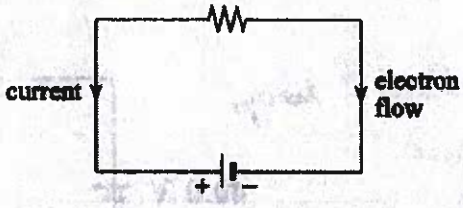
9.

Which of the following correctly shows the direction of conventional current and electron flow?

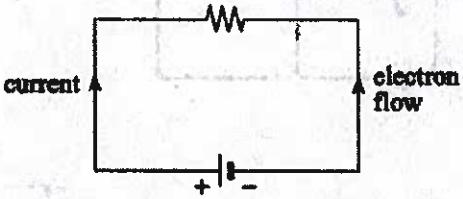
A.



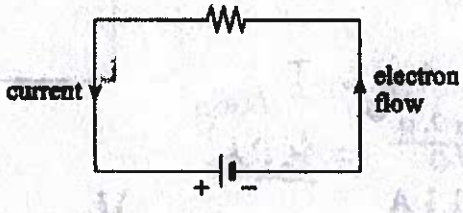
B.



C.



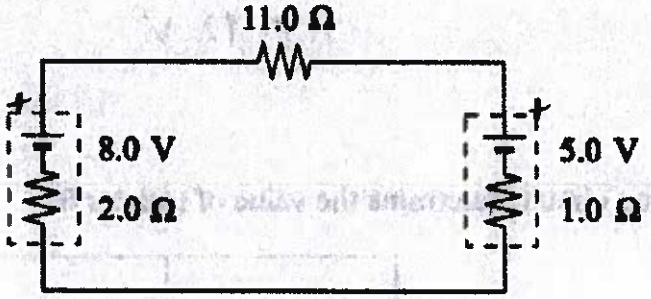
D.



10.

What current flows through the 11.0 Ω resistor?

V_{TOT} = potential difference between the 2 batteries



A. 0.21 A
B. 0.27 A
C. 0.93 A
D. 1.2 A

$R_{eq} = 2.0 + 11.0 + 1.0$
$= 14\Omega$

$I_{TOT} = \frac{V_{TOT}}{R_{eq}}$

$V_{TOT} = 8.0 - 5.0$
$= 3.0V$

$= \frac{3.0}{14}$

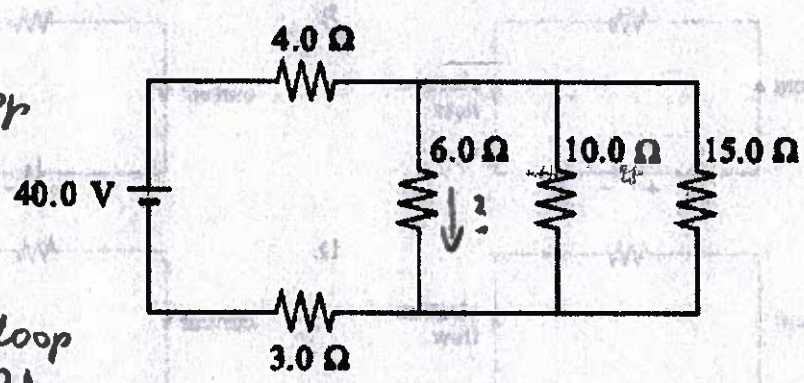
$= 0.21$ A

$$\frac{1}{R_{loop}} = \frac{1}{6} + \frac{1}{10} + \frac{1}{15} \quad \rightarrow \quad R_{loop} = \frac{5+3+2}{30} = \frac{10}{30}$$

$$R_{eq} = \frac{30}{10} = 3\,\Omega$$

11.

Calculate the current through the 6.0 Ω resistor in the circuit shown.



$R_{eq} = 4.0 + 3.0 + R_{loop}$

$= 7.0 + 3.0$

$= 10\,\Omega$

$I_{TOT} = I_4 = I_3 = I_{loop}$

$= \frac{40.0}{10} = 4.0\,A$

A. 1.1 A
B. 2.0 A
C. 4.0 A
D. 6.7 A

$V_{loop} = V_6 = V_{10} = V_{15}$

$= V_{Battery} - V_4 - V_3$

$= 40 - (4)(4) - (4)(3)$

$= 12\,V$

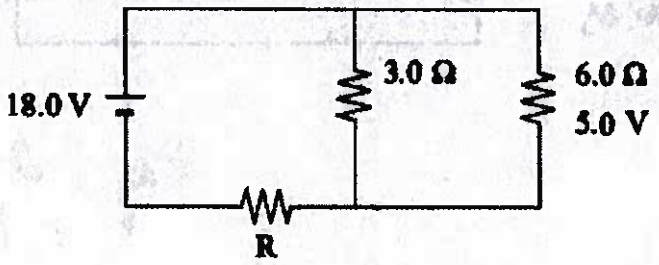
$I_6 = \frac{V_6}{R_6}$

$= \frac{12}{6}$

$= 2\,A$

12.

. **In the following circuit, determine the value of resistor R.**



$V_{loop} = V_6 = V_3$

$= 5.0\,V$

A. 3.2 Ω
B. 5.2 Ω
C. 9.0 Ω
D. 23 Ω

$V_R = V_{Battery} - V_{loop}$

$= 18.0 - 5.0$

$= 13.0\,V$

$I_R = I_3 + I_6$

$= \frac{5}{3} + \frac{5}{6}$

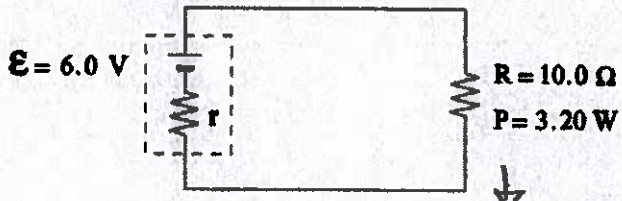
$= \frac{10+5}{6}$

$= 2.5\,A$

$R = \frac{V_R}{I_R} = \frac{13.0}{2.5} = 5.2\,\Omega$

13.

A battery provides 3.20 W of power to an external resistance. What power is dissipated as heat by the internal resistance within the battery?



A. 0.19 W
B. 3.4 W
C. 3.6 W
D. 60 W

$P = I^2 r$

$I = \sqrt{\frac{P}{R}}$

$I = \sqrt{\frac{3.2}{10}}$

$I = 0.5657\ A$

$P = 0.5657^2 (0.606$

$= 0.19\ W$

$V_{term} = V_R$

$\mathcal{E} - Ir = IR$

$\frac{6}{I} - \frac{Ir}{I} = \frac{I \cdot 10}{I}$

$\frac{6}{0.5657} - r = 10$

$-r = 10 - 10.6066$

$r = 0.606652\ \Omega$

14.

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

$P = IV = I^2 R$

$\rightarrow R = \frac{P}{I^2}$

$P = 75\ W$

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

$= \frac{75}{120}$

$= 0.625\ A$

$R = \frac{75}{0.625^2}$

$R = 192\ \Omega$