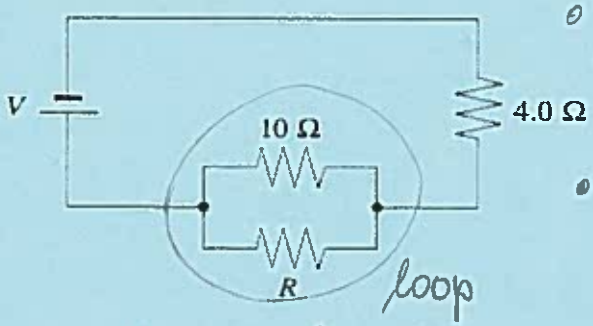
PHYSICS 11

ELECTRIC CIRCUITS

KEY

1.

What value of R in the circuit shown below will cause the parallel combination (10 Ω and R) to dissipate the same power as the 4.0 Ω resistor?



A. 0.26 Ω
B. 2.9 Ω
C. 6.0 Ω
D. 6.7 Ω

- $P = IV = I^2R$
- $P_{loop} = P_4 \Leftrightarrow R_{loop} = 4.0\,\Omega$
- loop
- $\frac{1}{R_{loop}} = \frac{1}{10} + \frac{1}{R}$
- $\frac{1}{R_{loop}} = \frac{R+10}{10R}$
- $R_{loop} = \frac{10R}{R+10}$

$4 = \frac{10R}{(R+10)}$

$4(R+10) = 10R$

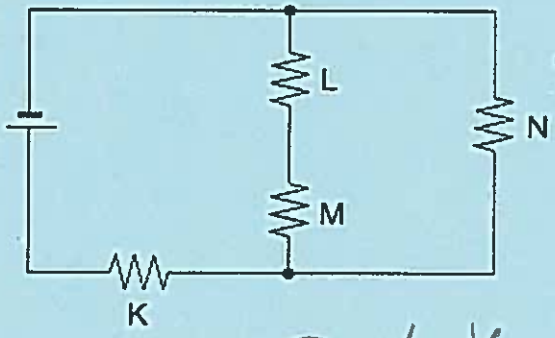
$4R + 40 = 10R$

$\frac{40}{6} = \frac{6R}{6}$

$R \doteq 6.7\,\Omega$

2.

All the resistors shown in the circuit have the same resistance value.



- $R_L = R_N = R_M = R_K$

Which resistor dissipates the most heat?

A. K
B. L
C. M
D. N

Find the greatest P as $P = \frac{Q}{\Delta t}$

$P = IV = I^2R$

⇒ if R is the same for all then the greatest P is caused by the greatest current (I)

⇒ R_L has the largest I: $I_L = I_{TOT}$

3.

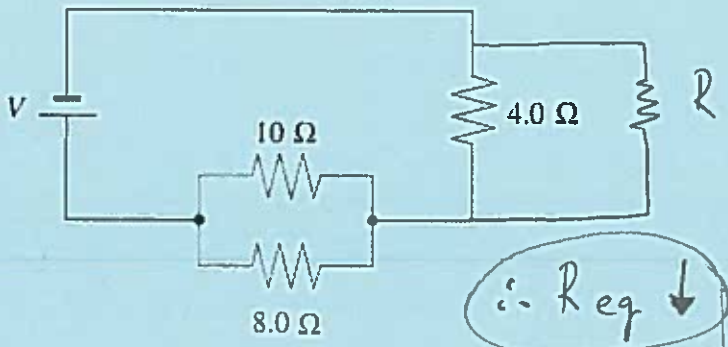
Before

3. A resistor is added in parallel to the 4.0 Ω resistor shown in the diagram below.

$R_{eq} = 4 + \frac{1}{\frac{1}{8}+\frac{1}{10}}$

$= 4 + 4.\bar{4}$

$= 8.\bar{4}\ \Omega$



After:

$R_{eq} = \frac{1}{\frac{1}{10}+\frac{1}{8}} + \frac{1}{\frac{1}{4}+\frac{1}{R}}$

$= 4.\bar{4} + \frac{1}{\frac{R+4}{4R}}$

$= 4.\bar{4} + \frac{4R}{R+4}$

$\therefore R_{eq} \downarrow$

$\frac{4R}{4+R} < 4$

as $4R < 4(4+R)$

$4R < 16 + 4R$ ✓

What happens to the power dissipated by the 8.0 Ω resistor and by the 4.0 Ω resistor?

	$P_{8.0\,\Omega}$	$P_{4.0\,\Omega}$
A.	decreases	increases
B.	decreases	decreases ✓
C.	increases ✓	increases
D.	increases ✓	decreases ✓

Observations:

$R_{eq} \downarrow$

$I_4 \downarrow \Rightarrow P_4 \downarrow$

$P = IV = I^2R$

V is constant,

if $R_{eq} \downarrow$

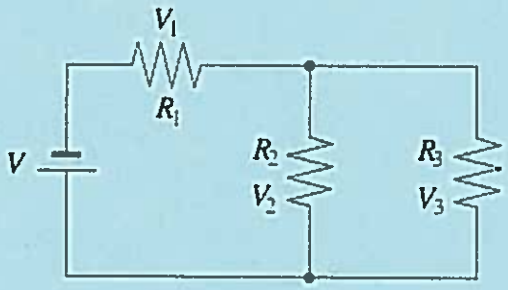
as $I_{TOT} = \frac{V_B}{R_{eq}}$ then $I_{TOT} \uparrow$

if $I_{TOT} \uparrow$, then $I_8 \uparrow$

thus $P_8 \uparrow$

4.

Which of the following statements is true for the electric circuit shown below, regardless of the resistors used?

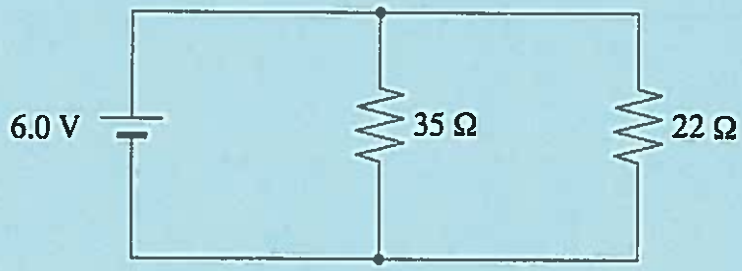


- $V_2 = V_3$ (parallel R)
- $V = V_1 + V_2 = V_1 + V_3$

A. $V_1 = V_2$
B. $V = V_2 + V_3$
C. $V = V_1 + V_3$
D. $V = V_1 + V_2 + V_3$

5.

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

$$I_{TOT} = \frac{V_B}{R_{eq}} = \frac{6.0}{13.5\ldots} = 0.44\ A$$

$$R_{eq}: \frac{1}{R_{loop}} = \frac{1}{\frac{1}{35} + \frac{1}{22}} = 13.50\ldots\ \Omega$$