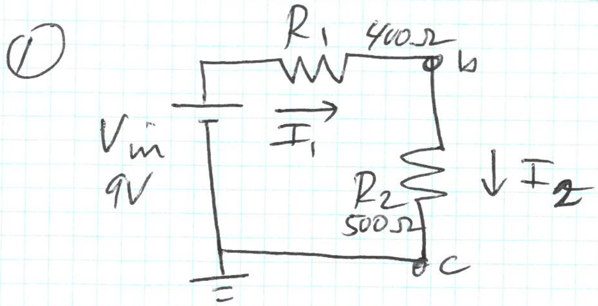
CIRCUITS INTRO QUIZ FALL 2002

SOLUTIONS

(1)



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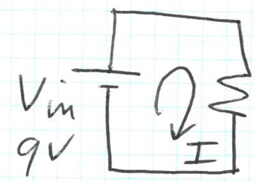


$R_s = R_1 + R_2 = 900\Omega$

↑ series resistance

a) We know $I_1 = I_2 = I$ (take KCL ~~@ nodes~~ @ node b)

$$I = \frac{V_{in}}{R_s} = \frac{9V}{900\Omega} = 0.1\ A = \boxed{10\ mA}$$

b)

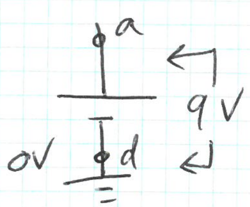
$I_2 = I = 10\ mA$

$$V_b - V_c = V_{R2} = I_2 R_2 = I R_2$$

(↑ by definition; ↓ Ohm's Law)

$$V_{R2} = (10\ mA)(500\Omega) = \boxed{5V}$$

c)



node d = <u>ground</u> (This is just ~~a reference~~ a reference point to which we assign 0V)

node a is $\boxed{9V}$ <u>higher</u> than node d. It's just the battery's voltage

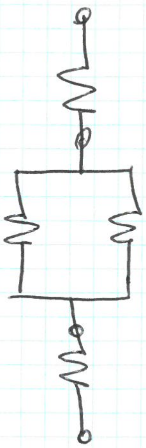
d) $I = \frac{dq}{dt} \Rightarrow dt = \frac{dq}{I}$ (dt: Δ time; dq: Δ charge capacity)

$dq = 1000$ mA hr to fully drain battery

$$dt = \frac{1000\ mA\ hr}{10\ mA} = \boxed{100\ hr}$$

e) "VOLTAGE DIVIDER" or "SERIES CIRCUIT"

(2)



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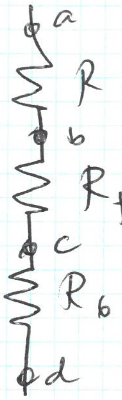


$R_p = R_4 \| R_5$ "R_4 in parallel with R_5"

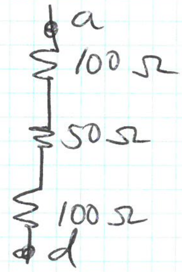
$$\frac{1}{R_p} = \frac{1}{R_4} + \frac{1}{R_5} = \frac{1}{100\,\Omega} + \frac{1}{100\,\Omega} = \frac{2}{100\,\Omega}$$

$\Rightarrow$ $\boxed{R_p = 50\,\Omega}$

note that this is $\frac{1}{2} \times 100\,\Omega$

Two equal resistance paths in parallel halves the equivalent resistance

Then just add in series



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↓

$\boxed{R_{eq} = 250\,\Omega}$ $100\,\Omega + 50\,\Omega + 100\,\Omega$

b) Decrease

adding resistors in parallel always decreases the equivalent resistance

(series always increases)

(3)

1	0	0	0	1	1	1	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

$= 128 + 8 + 4 + 2 + 1$

$= 128 + 15 = \underline{\underline{143}}$