Electric Circuits Practice Test Name: Answer Key

Multiple Choice (3 pts each)
Choose the best response

1) Distinguish between a series circuit and a parallel circuit.
a. Parallel – one path for electrons, Series – multiple paths.
b. Parallel – multiple paths, Series – one path for electrons.

2) In a **series** circuit, every element experiences the same
a. voltage.
b. current.
c. resistance.
d. power.

3) In a **parallel** circuit, every branch experiences the same
a. voltage.
b. current.
c. resistance.
d. power.

4) For resistors in **series**, the total resistance is equal to
a. the sum of the resistances divided by the product of the resistances.
b. the product of the resistances divided by the sum of the resistances.
c. the sum of the individual resistances divided by the number of resistors.
d. the sum of the individual resistances.

5) For **two** resistors in **parallel**, the total resistance can be found by
a. the formula $R_{eq} = (1/R_1 + 1/R_2)^{-1}$. → more general...
b. the product of the resistances divided by the sum of the resistances. → special case if working with only 2 resistances in parallel
c. the sum of the resistances divided by the product of the resistances.
d. either **a** or **b**.

6) What is the equivalent resistance (R_{eq}) of a 100 Ω resistor and a 440 Ω resistor in **series**?
a. 81.5 Ω.
b. 270 Ω.
c. 540 Ω.
d. 1080 Ω.

$100 + 440 = 540$

7) What is the equivalent resistance (R_{eq}) of a 100 Ω resistor and a 440 Ω resistor in **parallel**?
a. 81.5 Ω. → Also, only one possible since only one less than 100Ω
b. 270 Ω.
c. 540 Ω.
d. it depends on the order in which they are connected.

$R_{eq} = \left(\frac{1}{100} + \frac{1}{440}\right)^{-1}$
$= (.01 + .00227...)^{-1} = 81.5\,\Omega$

8) Calculate the current in a 12 Volt battery that is connected to *three* 5 Ω resistors in **parallel**.
a. 0.8 A.
b. 1.67 A.
c. 5 A.
d. 7.2 A.

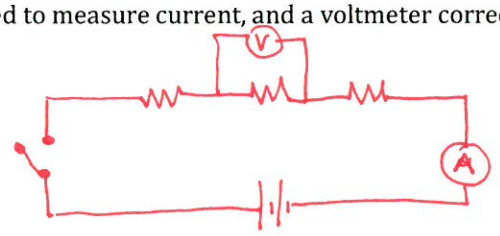
$R_{eq} = \left(\frac{1}{5} + \frac{1}{5} + \frac{1}{5}\right)^{-1} = \left(\frac{3}{5}\right)^{-1} = 5/3 = 1.67\Omega$
$V = IR$
$12V = I(1.67\Omega)$ $I = 7.1856$

9) Calculate the current in a 12 Volt battery that is connected to a 1 Ω, 2 Ω, 3 Ω and 4 Ω resistor in **series**.
a. 1.2 A.
b. 4.8 A.
c. 10 A.
d. 25 A.

$R_{eq} = 1+2+3+4 = 10\Omega = R_{eq}$
$V = IR$
$12 = I(10\Omega)$
$I = 1.2A$

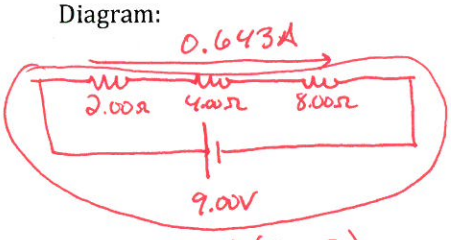
Free Response (#10-11points, #11-20 points, #12-20 points, #13-11 points, #14-11 points)

10) Using the standard symbols we discussed in class, draw a **series** circuit with three resistors, a switch, a battery, an ammeter correctly connected to measure current, and a voltmeter correctly connected to measure the voltage drop across the middle resistor.



11) Using the standard symbols we discussed in class, draw a **series** circuit with three resistors of values 2.00 Ω, 4.00 Ω, and 8.00 Ω as well as a battery of voltage 9.00 V. Next find the equivalent resistance of the circuit and the total current in the circuit. Finally, calculate the voltage drop across each of the three resistors. Show all calculations!

Diagram:



$R_{eq} = 2+4+8 = 14\Omega$

$V = IR$

$\frac{9V}{14} = \frac{I(14\Omega)}{14}$

$I = 0.642857A$ Everywhere

$V_2 = (.642857A)(2.00\Omega)$

$= 1.2857$

$V_4 = (.642857A)(4.00\Omega)$

$= 2.5714$

$V_8 = (.642857)(8.00\Omega)$

$= 5.142857$

Check...

$1.29 + 2.57 + 5.14 = 9.00V$ OK ✓

3 s.f.

$R_{eq} = 14.0\Omega$

$I = 0.643\ A$

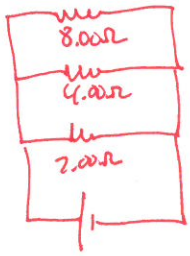
$\Delta V_2 = 1.29V$

$\Delta V_4 = 2.57V$

$\Delta V_8 = 5.14V$

12) Using the standard symbols we discussed in class, draw a **parallel** circuit with three resistors of values 2.00 Ω, 4.00 Ω, and 8.00 Ω as well as a battery of voltage 9.00 V. Next find the equivalent resistance of the circuit and the total current in the circuit. Finally, calculate the current in each of the three resistors. Show all calculations!

Diagram:



$R_{eq} = \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8}\right)^{-1}$

$= (.5 + .25 + .125)^{-1}$

$= (.875)^{-1}$

$= 1.142857$ (less than two so OK!)

$V_T = I_T R_T$

$9V = I_T (1.142857)$

$I_T = 7.875A$

$V = IR$ for each...

$9 = I(2)$

$I = 4.50$

$9 = I(4)$

$I = 2.25$

$8 = I(4)$

$I = 2.00$

Check...

$4.5 + 2.25 + 2 = 7.875$ ✓

3 s.f.

$R_{eq} = 1.14\Omega$

$I_{total} = 7.88\ A$

$I_2 = 4.50A$

$I_4 = 2.25A$

$I_8 = 2.00\ A$

13) Many homes now have a digital video recorder (DVR) that constantly records television programs. What is the current supplying such a DVR that has a power rated at 55 Watts when connected to 120 V?

$P = IV$

$\frac{55W}{120} = \frac{I(120V)}{120}$

$I = 0.4583$

2 s.f. so $0.46A$

14) What does it cost to operate the DVR in the previous question each month if the cost of electrical energy is $0.125/kWh?

Well 55W = 0.055kW

1 month = 30 days × 24 hr/day = 720 hrs

Energy = (0.055kW)(720hr) = 39.6 kW·hr

39.6 kW·hr × $.125/kW·hr = $4.95