ENGR 120 **Exam 1** **Name : _____**

Written Portion: Allowed materials include calculator (without wireless capability), pencil or pen.

Honor Statement: On my honor, I promise that I have not received any outside assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, . . .). _____signature

Information that you may need:

1 coulomb = $6.24(10)^{18}$ electrons
Avogadro's Number = $6.022(10)^{23}$ per mol

$$volume\ of\ cylinder = \frac{\pi \cdot diameter^2}{4} \cdot height$$

1 inch = 2.54 cm

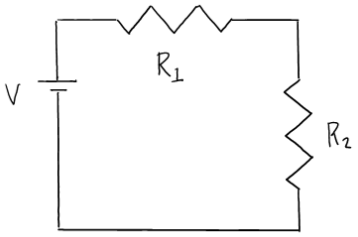
$$Cu = 1s^2\ 2s^2 2p^6\ 3s^2 3p^6 3d^{10}\ 4s^1$$

color	digit
black	0
brown	1
red	2
orange	3
yellow	4
green	5
blue	6
violet	7
gray	8
white	9

Note: The first 10 problems of this exam, which mostly included qualitative content from the notes, were deleted.

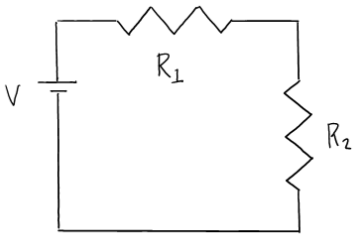
11. **(5 points)** Given the circuit shown below where V = 5 Volts, R1 = 100 Ohms, and R2 = 220 Ohms, the power in the 220 Ohm resistor is closest to:

    a. 0.014 Watts
    b. 0.034 Watts
    c. 0.054 Watts
    d. 0.074 Watts
    e. 0.094 Watts
    f. 0.114 Watts
    g. 0.134 Watts



12. **(5 points)** Given the circuit shown below where V = 9 Volts, R1 = 220 Ohms, and R2 = 470 Ohms, the voltage drop across the 470 Ohm resistor is closest to:

    a. 3.13 Volts
    b. 3.63 Volts
    c. 4.13 Volts
    d. 4.63 Volts
    e. 5.13 Volts
    f. 5.63 Volts
    g. 6.13 Volts
    h. 6.63 Volts



13. **(5 points)** Given a solid cylinder of pure copper with a diameter of 0.5 inches and a height of 2 inches. The number of valence electrons in the copper cylinder is closest to:

a. 4.452×10^{23}
b. 4.952×10^{23}
c. 5.452×10^{23}
d. 5.952×10^{23}
e. 6.452×10^{23}
f. 6.952×10^{23}
g. 7.452×10^{23}
h. 7.952×10^{23}

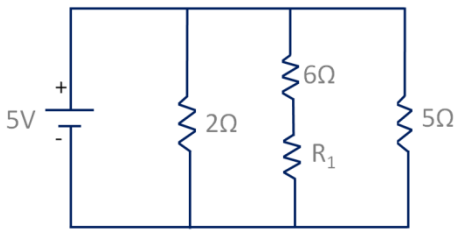
Atomic weight of Cu:	$63.55 \ \frac{g}{mol}$
Density of Cu:	$8.94 \ \frac{g}{cm^3}$
Avogadro's Number:	$6.022 * 10^{23} \ \frac{atoms}{mol}$

14. **(5 points)** A light bulb is powered using an AA battery rated at 2500mA·hr. The 1.5V battery lasts for 120 hours before the light bulb dims completely. Assuming a constant current, what is the resistance of the light bulb?

a. 0.014 Ω
b. 0.072 Ω
c. 60 Ω
d. 72 Ω
e. 220 Ω
f. 450 Ω

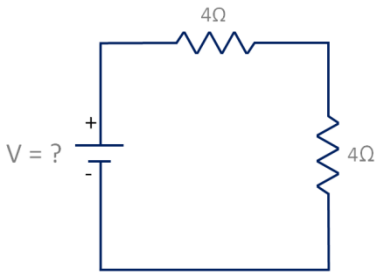
15. **(5 points)** If the total current leaving the 5 V source is 4 A, then the value of R1 is closest to:

a. 1 Ω
b. 2 Ω
c. 3 Ω
d. 4 Ω
e. 5 Ω



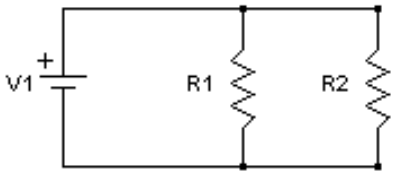
16. **(5 points)** If the power dissipated by each resistor is 9 W, then the value of the voltage source is closest to:

    a. 4 V
    b. 5 V
    c. 6 V
    d. 9 V
    e. 12 V



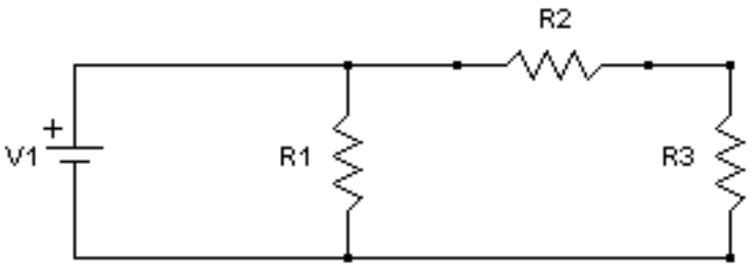
17. **(5 points)** For the circuit below (where V1 = 9V, R1 = 330Ω, R2 = 1kΩ), the current passing through R1 is closest to:

    a. 0.011A
    b. 0.027A
    c. 0.064A
    d. 0.191A
    e. 0.333A



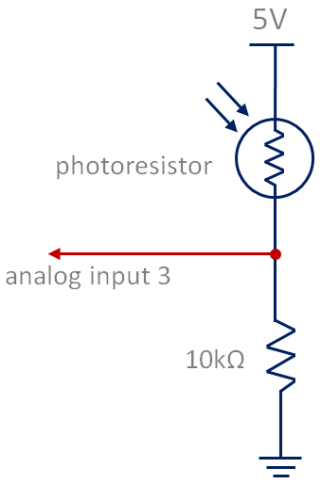
18. **(5 points)** For the circuit below (where V1 = 5V, R1 = 1000Ω, R2 = 470Ω, R3 = 220Ω), the voltage drop across R3 is closest to:

    a. 1.6V
    b. 2.4V
    c. 3.9V
    d. 4.1V
    e. 5.0V



19. **(5 points)** When the photoresistor in the circuit diagram below has a resistance of 20kΩ, the integer value returned by the **`analogRead(3)`** function will be closest to:

a. 84
b. 208
c. 291
d. 341
e. 388
f. 503
g. 650
h. 732
i. 821
j. 1011



20. **(5 points)** The formula to find the density of a gas is

$$\text{density} = \frac{P}{R \cdot T}$$

where **P** is pressure, **R** is a gas-specific constant, and **T** is absolute temperature. If you would like to enter a formula for density of CO_2 into cell C8 in such a way as to be able to copy and paste it (or fill with the little black square on the lower right of C8) into all the cells in the block C8:F12 without modification, then you should enter the formula:

	A	B	C	D	E	F
1		Gas Constants				
2		CO_2	189	J/(kg*K)		
3		H_2	4127	J/(kg*K)		
4		O_2	260	J/(kg*K)		
5						
6		Temperature (K):	275	280	285	290
7		Pressure (kPa):	Density (kg/m^3)			
8		90	1.732			
9		95				
10		100				
11		105				
12		110				

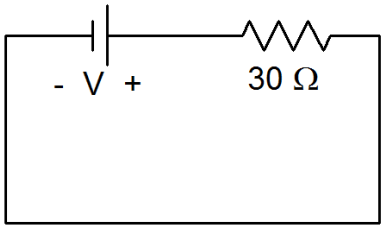
a. =B8/($C2*C6)
b. =$B8/($C$2*C$6)
c. =B$8/($C$2*$C6)
d. =B8*1000/($C$2*C6)
e. =$B$8*1000/($C$2*$C$6)
f. =B$8*1000/($C$2*$C6)
g. =$B8*1000/($C$2*C$6)
h. =$B$8/(1000*$C$2*C6)
i. =$B8/(1000*$C$2*C$6)
j. = B$8/(1000*$C$2*$C6)

Note: *It would be a good idea to carry out a hand calculation to make sure you are handling the units correctly.*

UNIT REMINDERS:

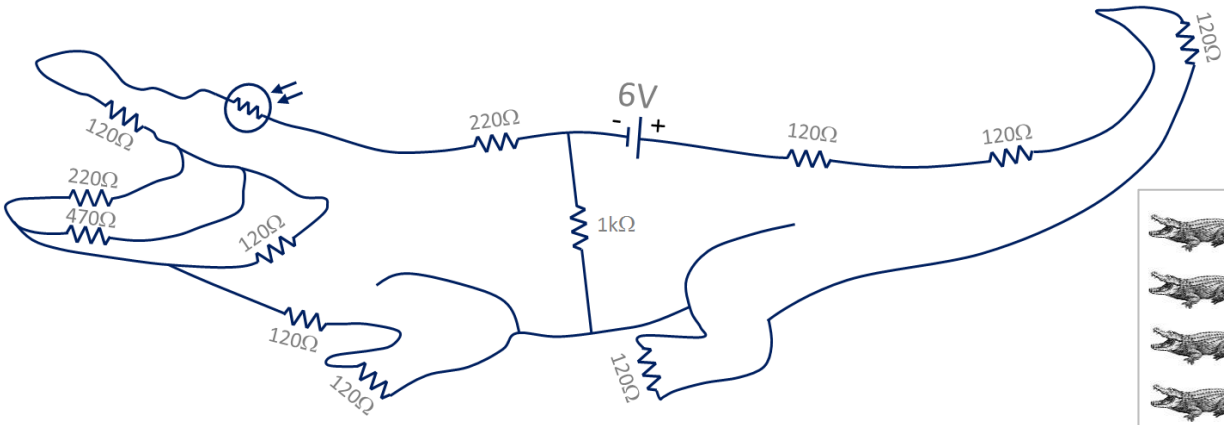
$Pa = \frac{N}{m^2}$ *and* $kPa = 1{,}000Pa$ *and* $J = N \cdot m$

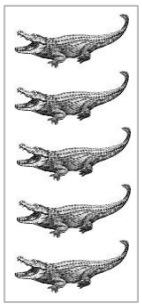
21. **(5 points)** Suppose the net number of electrons that leave the negative side of the battery in 2 hours is 2.247×10^{22}. The power being dissipated by the resistor would be closest to:



a. 97 MW (MW = megawatts: 10^6 Watts)
b. 97 kW (kW = kilowatts: 10^3 Watts)
c. 27 kW
d. 900 W
e. 30 W
f. 15 W
g. 7.5 W
h. 17 mW (mW = milliwatts: 10^{-3} Watts)
i. 8.3 mW

22. **(5 points)** Assuming the resistance of the photoresistor in the problem below is 100Ω, then the power dissipated at the photoresistor is closest to:





alligator scale rating = 5/10

a. 1mW (mW = milliwatt = 0.001 watt)
b. 1.4mW
c. 2.0mW
d. 2.4mW
e. 2.9mW
f. 3.3mW
g. 4.0mW
h. 6.7mW
i. 1.2W

ENGR 120 Exam 1 Name: _____

Computer Portion: Allowed materials include calculator, computer and Mathcad. The radio on your computer must be turned off when working this exam (no wireless connection is allowed).

Honor Statement: On my honor, I promise that I have not received any outside assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, my network connectivity was not turned on, . . .). _____signature

please raise your hand after finishing the problem

(10 points) Complete the following activities using Mathcad. **Note:** If you can't do the units, just omit them for partial credit.

(a) Enter the function below for an equivalent resistance as a function of an unknown resistor R1 (the syntax of your function will be different since you are creating a function): $$Req = \frac{1}{\frac{1}{120\Omega} + \frac{1}{220\Omega} + \frac{1}{470\Omega + R1}}$$	***INSTRUCTOR CHECK OF WORK:*** ☐ equivalent resistance function defined ☐ function for current is defined ☐ range variable correctly entered ☐ an appropriate plot of I versus R1 is presented
(b) Enter a function for the current for a voltage source of 5 volts (the syntax of your function won't look just like the one below): $$I = \frac{5\ volts}{Req}$$	***INSTRUCTOR NOTES:*** ☐ units not embedded in Mathcad analysis
(c) Create a range variable allowing R1 to vary from 30Ω to 1000Ω in steps of 10Ω.	
(d) Plot I versus R1.	