Name:_____ Instructor:_____ ENGR 120 - Exam 1
Section:_____ October 11, 2016

Allowed Materials: *F.E. approved calculator(s) see syllabus; pencils and/or pens.*

ExamForm := 11

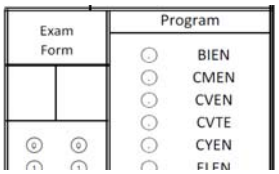
Honor Statement: *On my honor, I promise that I have not received any unauthorized assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, I didn't use an unauthorized calculator, I didn't use any electronic device, any visual or auditory signals, or any other techniques of exchanging information with others.) I have maintained the highest standards of academic integrity while completing this exam.*

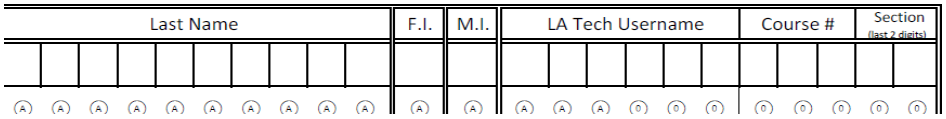
*Signed:*_____

1. *(2 point deduction for failure to complete this problem!)*

- Write in all of the indicated information in the boxes of your response form.
- Darken the appropriate circles to encode the corresponding information.
- Write your name on this exam and sign the Honor Statement.

Notes:
- If your last name is too long, just write the first 10 letters.
- "**F.I.**" and "**M.I.**" are your first and middle initials, respectively
- Your **"Username"** is the first part of your LATech email address
- For **"Section"** use the guide provided to the right
- Your **"Exam Form"** is printed on the upper right corner of this page.
- Indicate "ENGR" as the **"Program"**





Bubble:	For Course Section:	
91	H01 - Harbour	MW 12-1:50
92	H02 - Long	TR 12-1:50
93	H03 - Cronk	MW 2-3:50
94	H04 - Scoggin	MW 4-5:50
95	H05 - Reeves	TR10-11:50
96	H06 - Easley	MW10-11:50
01	001 - Bhattarai	MW10-11:50
02	002 - Scoggin	MW 2-3:50
03	003 - Cronk	TR 2-3:50
04	004 - Scoggin	MW 8-9:50
05	005 - Hartmann	TR 4-5:50
06	006 - Corbett	TR 12-1:50
07	007 - Pathak	MW 12-1:50
08	008 - Cronk	MW 4-5:50

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"I properly completed all required items in problem 1, so I will not lose these points"} \\ \text{"B"} & \text{"I did not properly complete problem 1 because I am fine with losing these points."} \end{pmatrix}$$

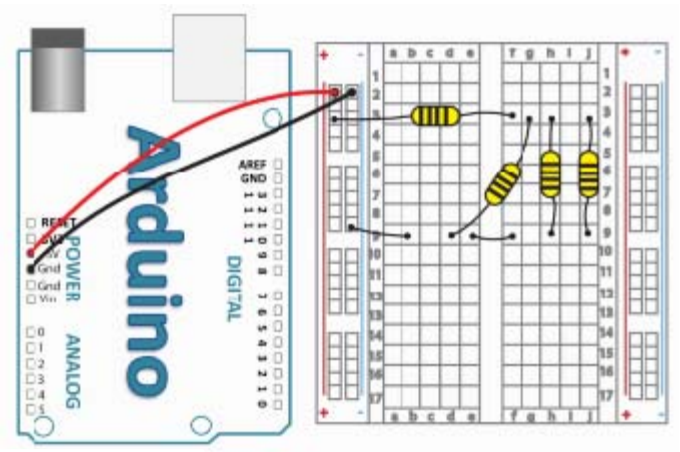
2. (3 points) Electrons migrate from _____ to _____ in a _____ path due to atom oscillation.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"shortage, supply, scattered"} \\ \text{"B"} & \text{"shortage, supply, straight"} \\ \text{"C"} & \text{"supply, shortage, scattered"} \\ \text{"D"} & \text{"shortage, supply, straight"} \\ \text{"E"} & \text{"positive, negative, scatered"} \\ \text{"F"} & \text{"supply, shortage, straight"} \\ \text{"G"} & \text{"positive, negative, scattered"} \end{pmatrix}$$

3. (3 points) Resistance can be described as:

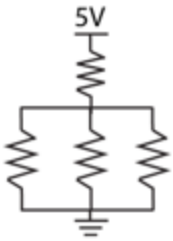
$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"The push that causes the electrons to start flowing"} \\ \text{"B"} & \text{"A material that is designed only to conduct under certain conditions"} \\ \text{"C"} & \text{"The rate at which charged particles pass a distance per unit of time"} \\ \text{"D"} & \text{"The frictional opposition encountered by electrons as they attempt to pass through a material"} \\ \text{"E"} & \text{"The work done per Coulomb of charge passing through a point"} \\ \text{"F"} & \text{"The potential difference of charged particles in a closed circuit"} \end{pmatrix}$$

4. (3 points) Given the image of the circuit on the Arduino, identify all of the correct symbolic representation(s).



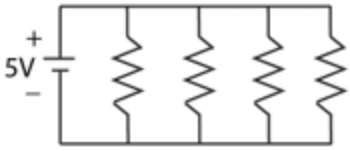
Choices =

"A"	"i and iv"
"B"	"i, iv, and v"
"C"	"ii, iv, and vii"
"D"	"i only"
"E"	"iv and v"
"F"	"ii and vii"
"G"	"i, ii, iv, and vii"
"H"	"ii only"

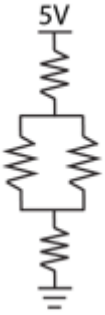


i.

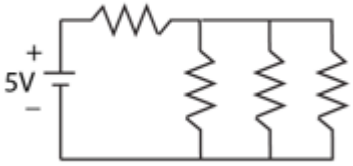
ii.



iii.

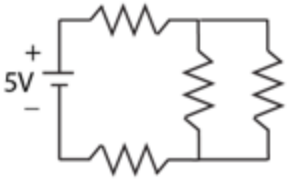


vii.



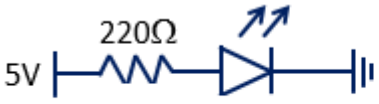
iv.

v.

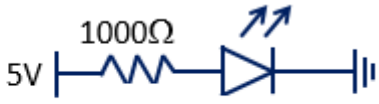


vi.

5. (3 points) Given the two circuits provided, the LED in circuit A will _____ than the LED in circuit B because the resistor in A _____



A



B

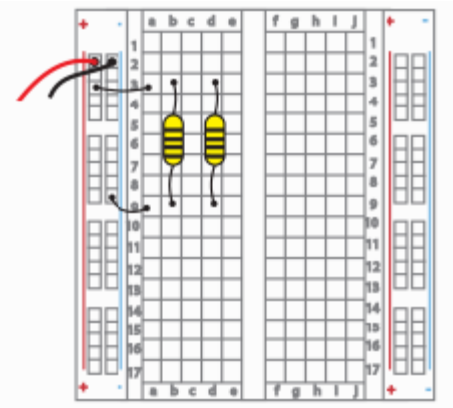
Choices =

"A"	"Burn out faster; is smaller"
"B"	"Be less bright; has less resistance and more current passes through to the LED"
"C"	"Have no difference in brightness; does not affect the brightness of an LED"
"D"	"Not enough information is given about the circuit to know."
"E"	"Be less bright; has less resistance and less current passes through to the LED"
"F"	"Be brighter; has less resistance and less current passes through to the LED"
"G"	"Be brighter; has less resistance and more current passes through to the LED"
"H"	"Burn out slower; is smaller"

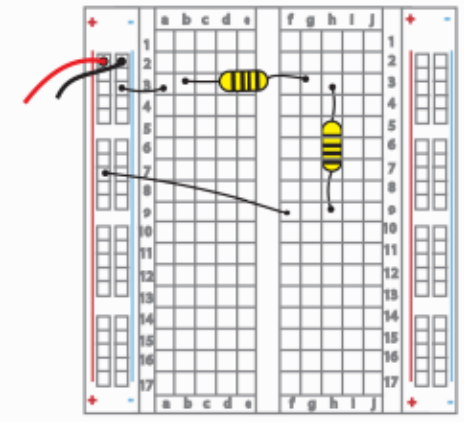
Note: the ; in the answer choices denotes the start of content for the second blank

6. (3 points) Identify all of the complete circuits as shown on the breadboard images below:

Assume the positive (+) column on the breadboard is plugged into +5V and the negative column (-) on the breadboard is plugged into ground. A "complete circuit" is one that will allow a flow of current from the positive column to the negative column of the breadboard.

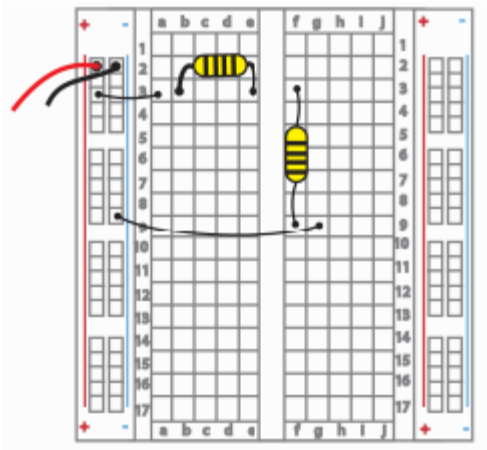


i.

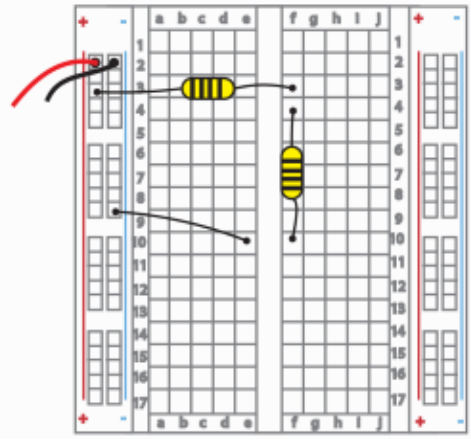


ii.

Choices = ("A" "ii, iii, and iv" ; "B" "i, ii, and iv" ; "C" "ii only" ; "D" "i and iii" ; "E" "i and ii" ; "F" "i only" ; "G" "iii only" ; "H" "i, iii, and iv")



iii.



iv.

7. (3 points) The below command will:

```
pinMode(13, OUTPUT)
```

Choices = ("A" "Set pin 13 to maintain 5V" ; "B" "Cause the LED to blink" ; "C" "Print in the serial monitor what the voltage of pin 13 is" ; "D" "Prepare pin 13 for inputs of voltage" ; "E" "Prepare pin 13 for outputs of voltage" ; "F" "Prepare the input from the output of pin 13" ; "G" "Prepare pin 13 for a delayed output" ; "H" "Prepare pin 13 for outputs of current")

8. (3 points) The `ln` in the below cammand will:

```
Serial.println(x);
```

Choices =

"A"	"initializes the serial monitor"
"B"	"takes the natural log of x"
"C"	"prints the value of x continuously on the same line"
"D"	"ln serves no purpose"
"E"	"prints the value of x upside down"
"F"	"prints the value of x and then moves to a new line"
"G"	"sets the baud rate for the serial monitor"
"H"	"prints the letters ln to the srial monitor"

9. (3 points) Given the code of the for loop, the number of times the command is executed is equal to:

```
for (int x=0; x <= 300; x++) {
    println(x);
}
```

Choices =

"A"	"298"
"B"	"301"
"C"	"299"
"D"	"297"
"E"	"304"
"F"	"306"
"G"	"not enough information"
"H"	"300"

10. (3 points) The substance that cleans the surface of a part being soldered and allows the solder to flow and stick is called:

Choices =

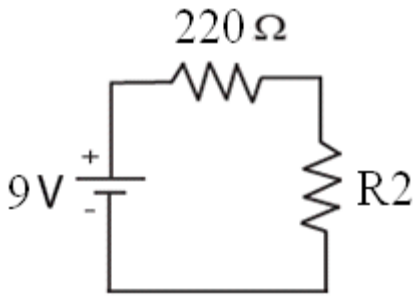
"A"	"Soldering Iron"
"B"	"Solder"
"C"	"Heat Shrink"
"D"	"Nibbling"
"E"	"Flux"
"F"	"Tinning"
"G"	"Solvent"
"H"	"Wax"

11. (3 points) If a switch does not allow electricity to flow through a set of contacts only when it is mechanically actuated, then those contacts are wired to be:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"Single throw"} \\ \text{"B"} & \text{"Normal Flow"} \\ \text{"C"} & \text{"Double throw"} \\ \text{"D"} & \text{"Abnormally open"} \\ \text{"E"} & \text{"Abnormally closed"} \\ \text{"F"} & \text{"Normally closed"} \\ \text{"G"} & \text{"Normally open"} \\ \text{"H"} & \text{"Normally Entered"} \end{pmatrix}$$

12. (5 points) Given the value of R2 shown below. The current leaving the source is closest to:

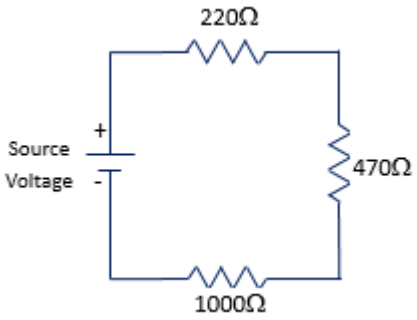
$R2 = 220\,\Omega$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.0061 \\ \text{"B"} & 0.0081 \\ \text{"C"} & 0.0102 \\ \text{"D"} & 0.0122 \\ \text{"E"} & 0.0143 \\ \text{"F"} & 0.0163 \\ \text{"G"} & 0.0184 \\ \text{"H"} & 0.0205 \end{pmatrix} \cdot \text{A}$$

13. (5 points) Given the value of the source voltage shown below, the voltage drop at the 1000Ω resistor is closest to:

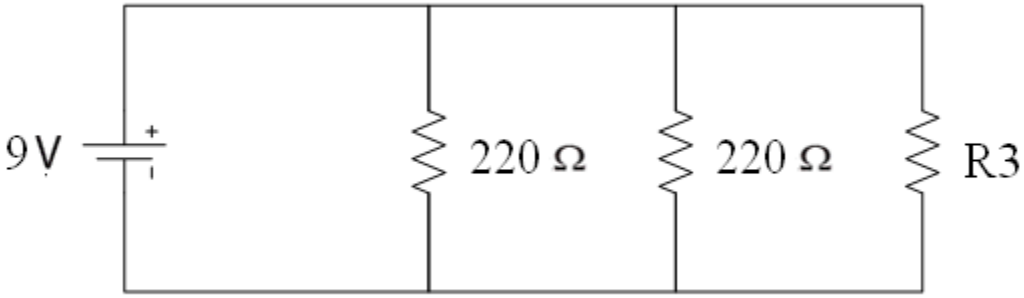
$\text{SourceVoltage} = 5\,\text{V}$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.75 \\ \text{"B"} & 2.96 \\ \text{"C"} & 3.17 \\ \text{"D"} & 3.38 \\ \text{"E"} & 3.59 \\ \text{"F"} & 3.79 \\ \text{"G"} & 4.00 \\ \text{"H"} & 4.22 \end{pmatrix} \text{V}$$

14. (5 points) (5 points) Given the value of R3 shown below, the equivalent resistance of the circuit is closest to:

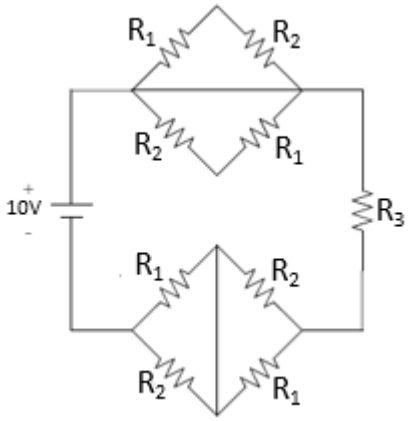
$R3 = 70\,\Omega$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 27.69 \\ \text{"B"} & 30.63 \\ \text{"C"} & 33.67 \\ \text{"D"} & 36.71 \\ \text{"E"} & 39.75 \\ \text{"F"} & 42.78 \\ \text{"G"} & 45.81 \\ \text{"H"} & 48.82 \end{pmatrix} \Omega$$

15. (5 points) The equivalent resistance of the resistor network shown below is closest to:

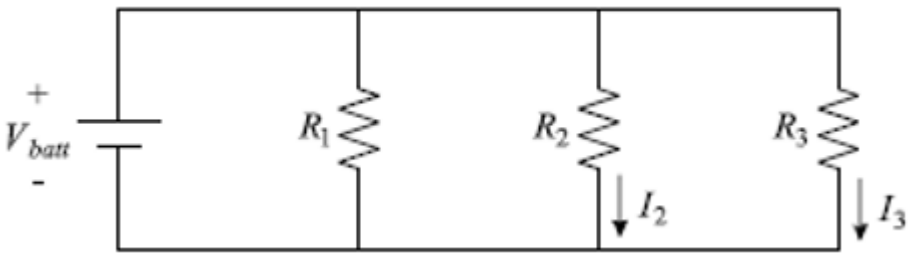
$R_1 = 40\,\Omega \quad R_2 = 20\,\Omega \quad R_3 = 50\,\Omega$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 38.789 \\ \text{"B"} & 44.100 \\ \text{"C"} & 49.601 \\ \text{"D"} & 54.940 \\ \text{"E"} & 60.364 \\ \text{"F"} & 65.803 \\ \text{"G"} & 71.232 \\ \text{"H"} & 76.667 \end{pmatrix} \Omega$$

16. (5 points) For the circuit below, if the current labeled $I_2 = 2\,A$ and $I_3 = 5\,A$, the total power supplied by the battery is closest to:

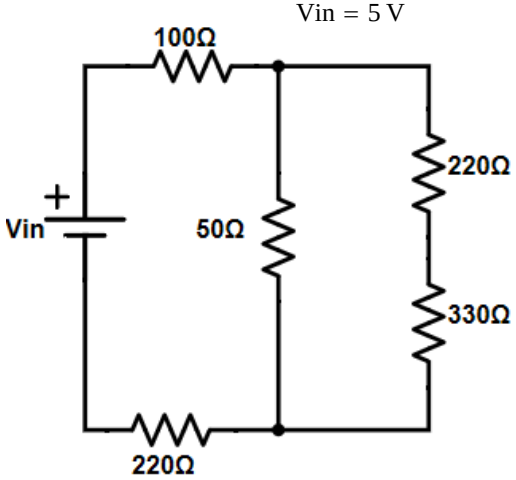
$R_1 = 7\,\Omega$ $R_2 = 5\,\Omega$ $R_3 = 2\,\Omega$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 66.46 \\ \text{"B"} & 72.33 \\ \text{"C"} & 78.31 \\ \text{"D"} & 84.29 \\ \text{"E"} & 90.26 \\ \text{"F"} & 96.25 \\ \text{"G"} & 102.15 \\ \text{"H"} & 108.12 \end{pmatrix} \cdot \text{W}$$

17. (5 points) Given the value of the voltage source Vin below, the voltage drop across the 50 Ω resistor is closest to:

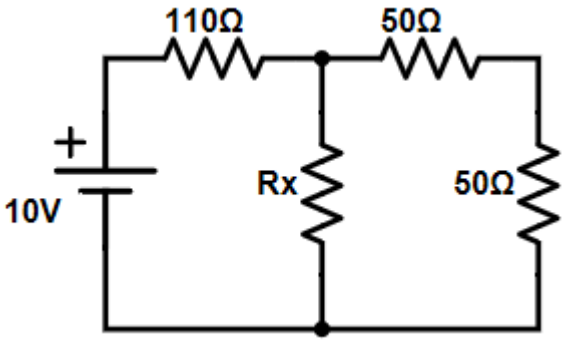
Vin = 5 V



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.248 \\ \text{"B"} & 0.311 \\ \text{"C"} & 0.375 \\ \text{"D"} & 0.437 \\ \text{"E"} & 0.500 \\ \text{"F"} & 0.563 \\ \text{"G"} & 0.626 \\ \text{"H"} & 0.690 \\ \text{"I"} & 0.753 \\ \text{"J"} & 0.816 \end{pmatrix} \cdot \text{V}$$

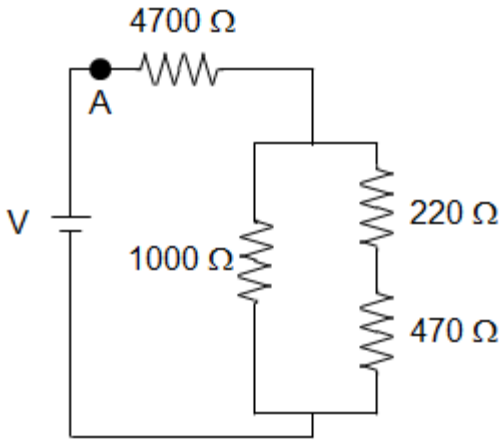
18. (5 points) For the circuit shown below, the power dissipated across the 110 Ω resistor is represented as P_{110}. The value of the unknown resistor, Rx, is closest to:

$P_{110} = 0.29\,W$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 354.25 \\ \text{"B"} & 387.51 \\ \text{"C"} & 420.97 \\ \text{"D"} & 454.90 \\ \text{"E"} & 488.44 \\ \text{"F"} & 522.31 \\ \text{"G"} & 556.12 \\ \text{"H"} & 590.04 \\ \text{"I"} & 623.58 \\ \text{"J"} & 657.13 \end{pmatrix} \cdot \Omega$$

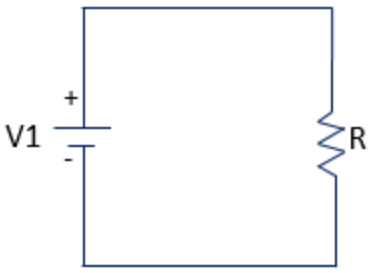
19. (5 points) Consider point A in the circuit below. When power is connected, electrons will flow past this point and through the resistors. If $\text{electrons} = 2 \times 10^{18}$ over a $\text{time} = 5.5s$ then the voltage drop across the 1,000 Ω resistor is closest to:



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 10.83 \\ \text{"B"} & 12.26 \\ \text{"C"} & 13.68 \\ \text{"D"} & 15.11 \\ \text{"E"} & 16.55 \\ \text{"F"} & 18.02 \\ \text{"G"} & 19.45 \\ \text{"H"} & 20.91 \\ \text{"I"} & 22.35 \\ \text{"J"} & 23.79 \end{pmatrix} \text{V}$$

20. (5 points) Suppose the net number of electrons that leave the negative side of a voltage source is $e = 2.43 \times 10^{20}$ electrons. For the voltage and resistance values given below, the length of time this circuit is in operation is closest to:

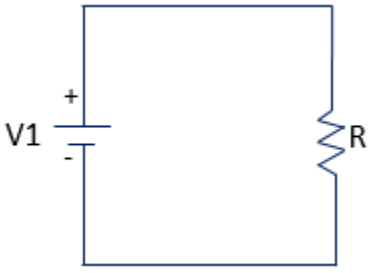
$V1 = 6.1\,V$ $R = 33\,\Omega$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 172.167 \\ \text{"B"} & 184.976 \\ \text{"C"} & 197.838 \\ \text{"D"} & 210.672 \\ \text{"E"} & 223.485 \\ \text{"F"} & 236.355 \\ \text{"G"} & 249.170 \\ \text{"H"} & 261.982 \\ \text{"I"} & 274.778 \\ \text{"J"} & 287.475 \end{pmatrix} \cdot s$$

21. (5 points) Suppose the net number of electrons that leave the negative side of a voltage source is $e = 4.63 \times 10^{19}$ electrons and the circuit has been in operation for $t = 2.5 \cdot hr$. For the voltage source value given below, the value of the resistor R is closest to ...

$V1 = 10.2\,V$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 10.87 \\ \text{"B"} & 11.62 \\ \text{"C"} & 12.37 \\ \text{"D"} & 13.13 \\ \text{"E"} & 13.88 \\ \text{"F"} & 14.63 \\ \text{"G"} & 15.39 \\ \text{"H"} & 16.12 \\ \text{"I"} & 16.89 \\ \text{"J"} & 17.64 \end{pmatrix} \cdot k\Omega$$

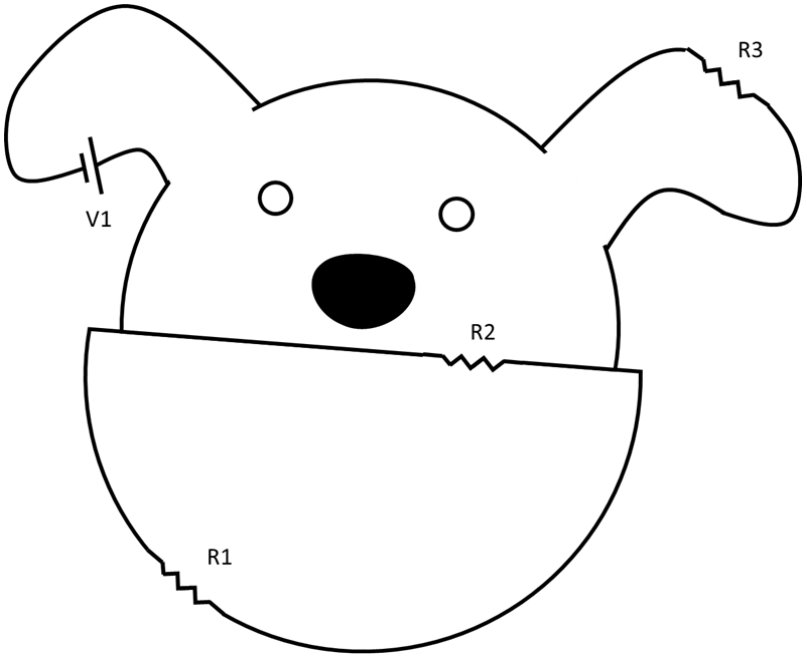
22. (5 points) For the given resistor values, find the power provided by Voltage Source.

$V_1 = 5\,V$

$R_1 = 13\,\Omega$

$R_2 = 9\,\Omega$

$R_3 = 14\,\Omega$

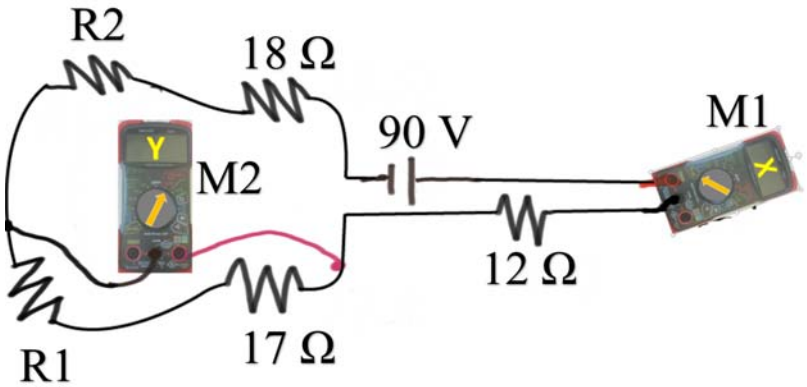


$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.78 \\ \text{"B"} & 25.00 \\ \text{"C"} & 4.70 \\ \text{"D"} & 1.92 \\ \text{"E"} & 1.29 \\ \text{"F"} & 1.79 \\ \text{"G"} & 0.69 \\ \text{"H"} & 19.32 \end{pmatrix} \text{ W}$$

23. (5 points) Two multimeters are used to analyze a circuit. Multimeter M1 measures X Amps and Multimeter M2 measures Y Volts. For the values of X and Y shown below, the value of resistor R2 should be closest to:

$X = 0.5\,A$

$Y = 38.4\,V$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 46.6 \\ \text{"B"} & 51 \\ \text{"C"} & 55.5 \\ \text{"D"} & 59.8 \\ \text{"E"} & 64.3 \\ \text{"F"} & 68.8 \\ \text{"G"} & 73.2 \\ \text{"H"} & 77.7 \\ \text{"I"} & 82.1 \\ \text{"J"} & 86.6 \end{pmatrix} \cdot \Omega$$

24. (5 points) Given the power absorbed by R_8, what is the current flowing through R_3?

Hint: No Source Voltage is Given.

$P_8 = 32\,W$

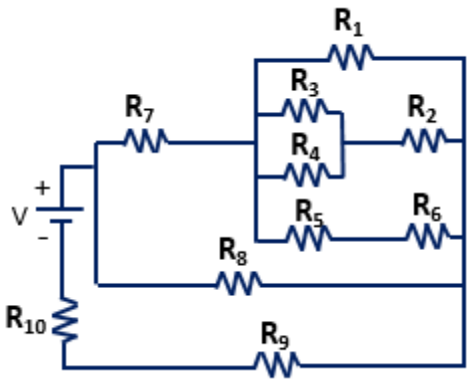
$R_1 = 11\,\Omega \quad R_6 = 32\,\Omega$

$R_2 = 10\,\Omega \quad R_7 = 12\,\Omega$

$R_3 = 29\,\Omega \quad R_8 = 25\,\Omega$

$R_4 = 75\,\Omega \quad R_9 = 52\,\Omega$

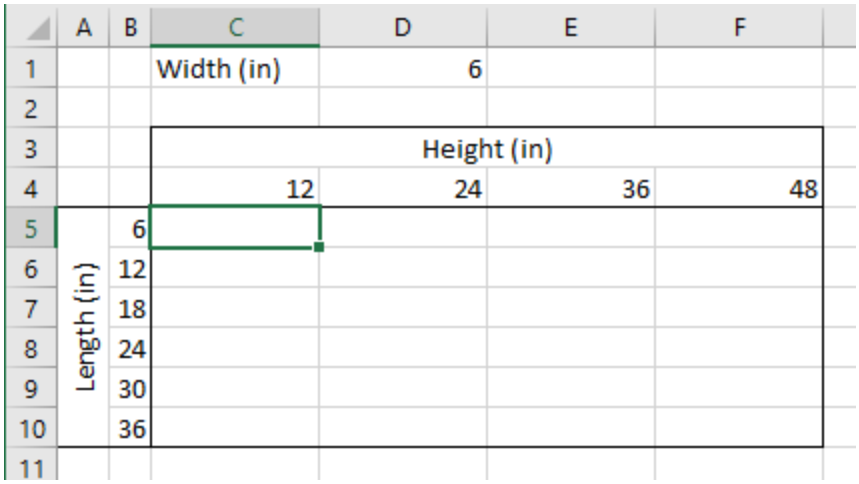
$R_5 = 132\,\Omega \quad R_{10} = 23\,\Omega$



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 134 \\ \text{"B"} & 154 \\ \text{"C"} & 175 \\ \text{"D"} & 196 \\ \text{"E"} & 217 \\ \text{"F"} & 238 \\ \text{"G"} & 259 \\ \text{"H"} & 279 \end{pmatrix} \cdot mA$$

25. (5 points) You are charged with making boxes from scrap pieces of flat cardboard. All your boxes must have a width shown in the figure below. The length and height of the box, however, may vary depending on the available piece of cardboard. You want to make a chart in Excel that will calculate the surface area of the various box sizes so that, for a given piece of cardboard, you can quickly tell if you are able to make a particular box size. What formula in cell C5 should you use to be able to click and drag to fill the rest of the table shown below?

Surface_Area = $2 \cdot W \cdot L + 2 \cdot H \cdot L + 2 \cdot W \cdot H$



	A	B	C	D	E	F
1			Width (in)	6		
2						
3			Height (in)			
4			12	24	36	48
5	Length (in)	6				
6		12				
7		18				
8		24				
9		30				
10		36				
11						

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"=2*(\$D\$1*C:\$+\$B:*C:\$+\$D\$1*\$B:)"} \\ \text{"B"} & \text{"=2*(\$D\$1*\$B5+C\$4*\$B5+\$D\$1*C\$4)"} \\ \text{"C"} & \text{"=2*(D1\$\$*C4\$+B5\$*C4\$+D1\$\$*B5\$)"} \\ \text{"D"} & \text{"=2*(\$D\$1*C\$5+\$B4*C\$5+\$D\$1*\$B4)"} \\ \text{"E"} & \text{"=2*(D\$\$1*C\$4+B\$5*C\$4+D\$\$1*B\$5)"} \\ \text{"F"} & \text{"=2*(\$\$D1*\$C4+\$B5*\$C4+\$\$D1*\$B5)"} \\ \text{"G"} & \text{"=2*\$D\$1*\$C4+2*B\$5*\$C4+2*\$D\$1*B\$5"} \\ \text{"H"} & \text{"=2*(\$1\$D*4\$C+\$5B*4\$C+\$1\$D*\$5B)"} \end{pmatrix}$$

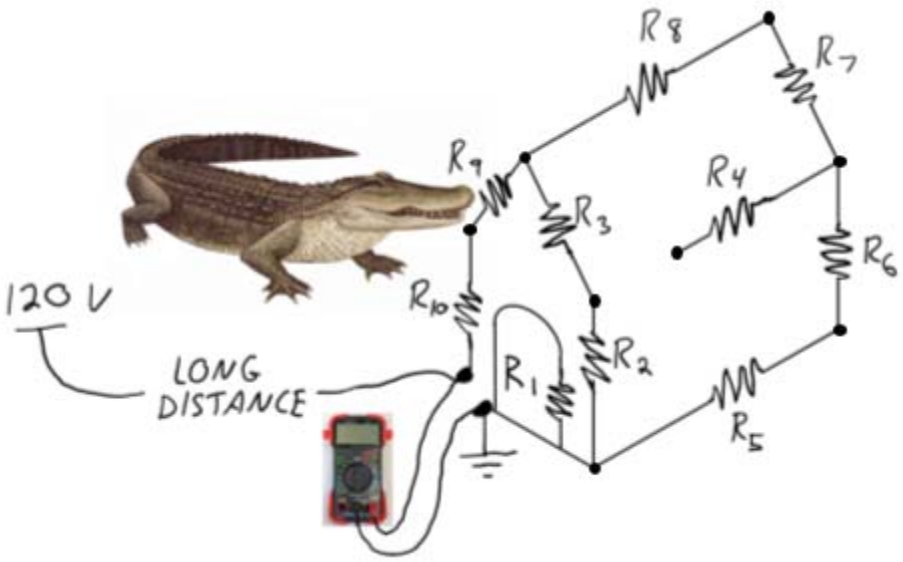
26. (5 points) Dr. Harbour's pet alligator Lig has trouble staying warm during the frigid Ruston winter, so Dr. Harbour has decided to build a special alligator house with heating elements built into the structure, as shown. The resistance of each heating element is listed near the figure. A wire is routed from Dr. Harbour's house to Lig's house to supply power.

Unfortunately, once the power has been turned on, Dr. Harbour's multimeter indicates a reduced voltage actually being applied to the gator house. He realizes this reduction is because the supply wire is so long that its resistance cannot be assumed zero as is usually assumed with wires. Considering the long wire between the power supply and Lig's house to function as a single resistor, the long wire's resistance is closest to:

$V_{meter} = 114\,V$ $R_3 = 21\,\Omega$ $R_6 = 30\,\Omega$ $R_9 = 15\,\Omega$

$R_1 = 15\,\Omega$ $R_4 = 42\,\Omega$ $R_7 = 5\,\Omega$ $R_{10} = 3\,\Omega$

$R_2 = 42\,\Omega$ $R_5 = 20\,\Omega$ $R_8 = 10\,\Omega$



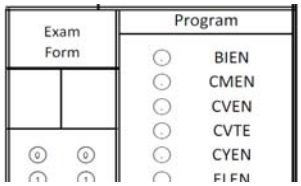
$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.311 \\ \text{"B"} & 2.472 \\ \text{"C"} & 2.631 \\ \text{"D"} & 2.791 \\ \text{"E"} & 2.950 \\ \text{"F"} & 3.111 \\ \text{"G"} & 3.271 \\ \text{"H"} & 3.430 \\ \text{"I"} & 3.589 \\ \text{"J"} & 3.754 \end{pmatrix} \cdot \Omega$$

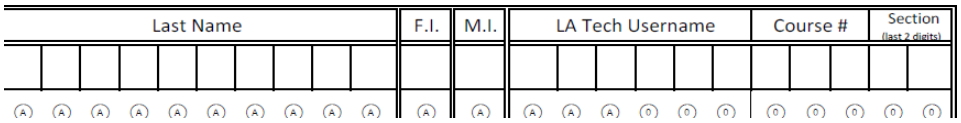
While you are waiting to begin your test:

- Please write and bubble your name and initials on your response sheet
- Please write and bubble your LATech username (e.g. abc567) on your response sheet
- Please write and bubble your section number on your response sheet using the guide shown here
- Please write and bubble your ExamForm number. This is your ExamForm: ExamForm= 11

Notes:

- If your last name is too long, just write the first 10 letters.
- "**F.I.**" and "**M.I.**" are your first and middle initials, respectively
- Your **"Username"** is the first part of your LATech email address
- For **"Section"** use the guide provided to the right
- Indicate "ENGR" as the **"Program"**





Bubble:	For Course Section:	
91	H01 - Harbour	MW 12-1:50
92	H02 - Long	TR 12-1:50
93	H03 - Cronk	MW 2-3:50
94	H04 - Scoggin	MW 4-5:50
95	H05 - Reeves	TR10-11:50
96	H06 - Easley	MW10-11:50
01	001 - Bhattarai	MW10-11:50
02	002 - Scoggin	MW 2-3:50
03	003 - Cronk	TR 2-3:50
04	004 - Scoggin	MW 8-9:50
05	005 - Hartmann	TR 4-5:50
06	006 - Corbett	TR 12-1:50
07	007 - Pathak	MW 12-1:50
08	008 - Cronk	MW 4-5:50

Also Note:

- Mobile phones or other electronic devices (other than FE-approved calculators and plain timepieces) are not allowed on this exam. If you have non-approved devices (including smartwatches), please deposit them at the front of the room for the duration of the exam. Don't forget to retrieve them when you prepare to depart.
- Please deposit any bags you might have brought in the front of the room for the duration of the exam.
- There is a reference sheet given below.
- If you need additional scratch paper, please ask your proctor. Turn in any scratch paper with your exam, even if unused.
- If you have questions during the exam, please remain in your seat and raise your hand. A proctor will come to you.
- Please use a restroom now if you need it so as to minimize potential disruptions during the exam.

Reference Information:

1 coulomb = $6.24(10)^{18}$ electrons

Avogadro's Number = $6.022(10)^{23}$ per mol

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

ExamForm = 11
ind = 1

181_ENGR120_E1
October 10, 2017

Key =

	1
1	"A"
2	"C"
3	"D"
4	"B"
5	"G"
6	"E"
7	"E"
8	"F"
9	"B"
10	"E"
11	"F"
12	"H"
13	"B"
14	"F"
15	"H"
16	"D"
17	"G"
18	"G"
19	"J"
20	"D"
21	"C"
22	"E"
23	"G"
24	"G"
25	"B"
26	"C"