Name:_____ Instructor:_____ ENGR 121 - Exam 2
Section:_____ May 16, 2017

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

ExamForm := 21

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.*

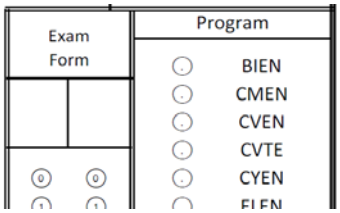
*Signed:*_____

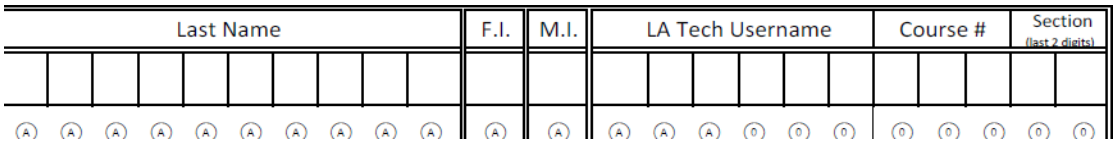
1. *(2 point deduction for failure to complete this problem!)*

Bubble:	For Course Section:	
01	001 - Corbett	TR 10-11:50
02	002 - Reis	TR 4-5:50

- 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"**





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

2. (3 points) The equation $\Delta E_{system} = E_{in} - E_{out}$ is referred to as:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"1st Law of Thermodynamics"} \\ \text{"B"} & \text{"Definition of a Derivative"} \\ \text{"C"} & \text{"Newton's Thermal Law"} \\ \text{"D"} & \text{"Thermal Energy Equation"} \\ \text{"E"} & \text{"Newton's Law"} \\ \text{"F"} & \text{"Energy Stabilizer"} \\ \text{"G"} & \text{"2nd Law of Thermodynamics"} \\ \text{"H"} & \text{"Balance of Energy Equilibrium"} \end{pmatrix}$$

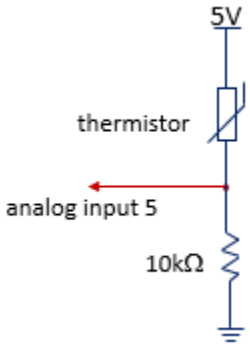
3. (3 points) The data type needed to properly calculate a decimal value is:

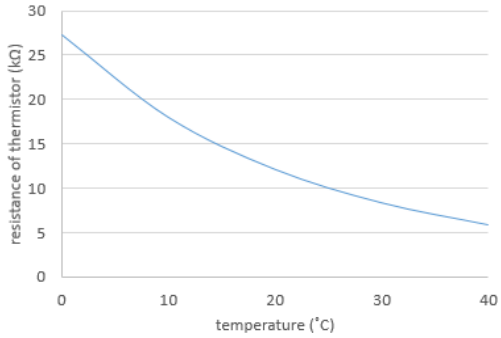
$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"int"} \\ \text{"B"} & \text{"long"} \\ \text{"C"} & \text{"decibyte"} \\ \text{"D"} & \text{"double"} \\ \text{"E"} & \text{"float"} \\ \text{"F"} & \text{"gigabyte"} \\ \text{"G"} & \text{"char"} \\ \text{"H"} & \text{"nib"} \end{pmatrix}$$

4. (3 points) Given the voltage divider circuit used for your thermistor and the thermistor resistance vs. temperature graph, the analog read values will increase when the thermistor measures:

Choices =

"A"	"an increase in salinity"
"B"	"cool air blowing across the thermistor"
"C"	"an increase in heat capacity"
"D"	"cool water touching the thermistor"
"E"	"a decrease in salinity"
"F"	"an increase in temperature"
"G"	"a decrease in temperature"
"H"	"a change in position"





5. (3 points) Advantages of the thermistor include:

I. High Output
II. Current Source Required
III. Fast
IV. Two-Wire Ohm Measurement
V. Self Heating
VI. Limited Temperature Range

Choices =

"A"	"III"
"B"	"I, III, & IV"
"C"	"II, V, & VI"
"D"	"V"
"E"	"I, V, VI"
"F"	"I, III, & V"
"G"	"III & VI"
"H"	"II"

6. (3 points) The addition of boron to silicon is called _____ and causes _____:

Choices =

"A"	"p-type doping, an extra electron to be available for insulation"
"B"	"n-type doping, a vacancy hole to allow conduction to occur"
"C"	"n-type doping, an increase in voltage"
"D"	"n-type doping, an extra electron to be available for insulation"
"E"	"p-type doping, a vacancy hole to allow conduction to occur"
"F"	"p-type doping, an increase in voltage"
"G"	"p-type doping, an extra electron to allow conduction to occur"
"H"	"n-type doping, an extra electron to allow conduction to occur"

7. (3 points) A relay whose contacts open when a current is passed though the coils preventing power from flowing through the contact leads is considered:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"normally poled"} \\ \text{"B"} & \text{"abnormally open"} \\ \text{"C"} & \text{"abnormally closed"} \\ \text{"D"} & \text{"double throw"} \\ \text{"E"} & \text{"double pole"} \\ \text{"F"} & \text{"normally closed"} \\ \text{"G"} & \text{"normally thrown"} \\ \text{"H"} & \text{"normally open"} \end{pmatrix}$$

8. (3 points) A semiconductor device that switches the flow of current between two terminals by varying the current of voltage between one of the terminals and a third is a:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"solenoid valve"} \\ \text{"B"} & \text{"transistor"} \\ \text{"C"} & \text{"resistor"} \\ \text{"D"} & \text{"LED"} \\ \text{"E"} & \text{"transformer"} \\ \text{"F"} & \text{"relay"} \\ \text{"G"} & \text{"electromagnet"} \\ \text{"H"} & \text{"flyback diode"} \end{pmatrix}$$

9. (3 points) The number of energy units needed to raise the temperature of a unit mass by one degree is:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"Singular Heat Function"} \\ \text{"B"} & \text{"Temperature Degree"} \\ \text{"C"} & \text{"Temperature"} \\ \text{"D"} & \text{"Heat Coefficient"} \\ \text{"E"} & \text{"Heat Capacity"} \\ \text{"F"} & \text{"Energy Heat Value"} \\ \text{"G"} & \text{"Special Heat"} \\ \text{"H"} & \text{"Boiling Point"} \end{pmatrix}$$

10. (3 points) In the fishtank system, the chemical reaction shown below represents:

$$2\,H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"one Hydrogen gas molecule forming for every one electron"} \\ \text{"B"} & \text{"oxidaton, a loss of electrons"} \\ \text{"C"} & \text{"temperature of the water heating up"} \\ \text{"D"} & \text{"reduction, a gain of electrons"} \\ \text{"E"} & \text{"the water getting saltier"} \\ \text{"F"} & \text{"reduction, a loss of electrons"} \\ \text{"G"} & \text{"oxidation, a gain of electrons"} \\ \text{"H"} & \text{"water forming"} \end{pmatrix}$$

11. (3 points) You are running the below commands in your main loop. You expect the time for the arduino to exceed 32,767 milliseconds. In this scenario, what data type should you assign to the timer variable at the start of the program?

```
timer = millis();
Serial.print("timer = "); Serial.print(timer); Serial.print ("ms");
```

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"float"} \\ \text{"B"} & \text{"decibyte"} \\ \text{"C"} & \text{"double"} \\ \text{"D"} & \text{"nib"} \\ \text{"E"} & \text{"gigabyte"} \\ \text{"F"} & \text{"char"} \\ \text{"G"} & \text{"long"} \\ \text{"H"} & \text{"int"} \end{pmatrix}$$

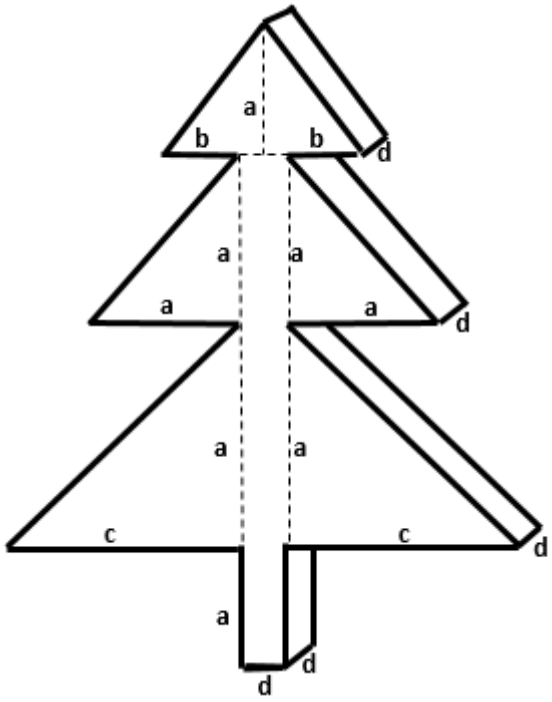
12. (5 points) Assume you have the amount of NaCl shown below added to 15 kg of water. The weight % of NaCl in the mixture is closest to:

$$\text{NaCl} = 200 \cdot \text{grams}$$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.92 \\ \text{"B"} & 1.00 \\ \text{"C"} & 1.08 \\ \text{"D"} & 1.16 \\ \text{"E"} & 1.24 \\ \text{"F"} & 1.32 \\ \text{"G"} & 1.40 \\ \text{"H"} & 1.48 \end{pmatrix} \cdot \%$$

13. Over the holidays, Dr. Harbour saw an ad on TV for a new water-filled Christmas tree. Normally each tree sells for $49.99, but wait, now you can get two trees for that same price (just pay separate shipping and handling).

If **one** tree as shown (see dimensions given below) is completely filled with water, then the mass of the water will be closest to:



$a = 1 \cdot m$

$b = 0.5 \cdot m$

$c = 1.5 \cdot m$

$d = 0.25 \cdot m$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 597.00 \\ \text{"B"} & 651.71 \\ \text{"C"} & 710.53 \\ \text{"D"} & 766.20 \\ \text{"E"} & 824.03 \\ \text{"F"} & 880.40 \\ \text{"G"} & 937.50 \\ \text{"H"} & 994.23 \end{pmatrix} \cdot kg$$

14. (5 points) The amount of DI water that you need to add to $m = 19.5 \cdot grams$ of NaCl to achieve a solution that has a $wt\%_{NaCl} = 0.123\%$ is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 11.99 \\ \text{"B"} & 12.96 \\ \text{"C"} & 13.92 \\ \text{"D"} & 14.87 \\ \text{"E"} & 15.83 \\ \text{"F"} & 16.79 \\ \text{"G"} & 17.77 \\ \text{"H"} & 18.72 \\ \text{"I"} & 19.67 \\ \text{"J"} & 20.64 \end{pmatrix} \cdot kg$$

15. (5 points) Your tomato soup ($\text{massSoup} = 0.24\text{kg}$) is too hot so in order to cool it down you drop ice into it. Each ice cube has a $\text{massIce} = 10\text{gram}$ and an initial temperature of -12 °C. Since ice is frozen water, it has the same properties as water. The specific heat of tomato soup is 3670 J/(kg °C). The number of ice cubes needed to change the temperature of the soup from 100 °C to78 °C is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 5 \\ \text{"B"} & 6 \\ \text{"C"} & 7 \\ \text{"D"} & 8 \\ \text{"E"} & 10 \\ \text{"F"} & 11 \\ \text{"G"} & 12 \\ \text{"H"} & 13 \\ \text{"I"} & 14 \\ \text{"J"} & 16 \end{pmatrix}$$

16. (5 points) A small chamber of water with a $\text{diameter} = 5\cdot\text{cm}$ and a $\text{depth} = 4\cdot\text{cm}$ is heated by a $\text{Resistor} = 18\Omega$ which is powered by a 12VDC power supply. The intial and final temperatures are given below. The time that the heater was on is closest to:

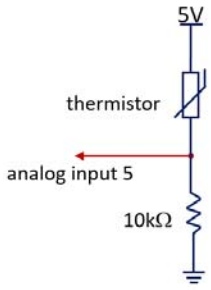
$T_1 = 20$ °C $T_2 = 24$ °C

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.24 \\ \text{"B"} & 2.40 \\ \text{"C"} & 2.57 \\ \text{"D"} & 2.74 \\ \text{"E"} & 2.90 \\ \text{"F"} & 3.07 \\ \text{"G"} & 3.23 \\ \text{"H"} & 3.40 \\ \text{"I"} & 3.56 \\ \text{"J"} & 3.74 \end{pmatrix} \cdot\text{min}$$

17. (5 points) A heater has a of $\text{Power} = 18\text{W}$ that remains on for $\text{time} = 30\text{s}$ heats a small volume of water. If the water temperature increases by $\Delta T = 12$ °C, then the volume of water in m^3 is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.00880 \\ \text{"B"} & 0.00946 \\ \text{"C"} & 0.01011 \\ \text{"D"} & 0.01077 \\ \text{"E"} & 0.01142 \\ \text{"F"} & 0.01208 \\ \text{"G"} & 0.01273 \\ \text{"H"} & 0.01338 \\ \text{"I"} & 0.01405 \\ \text{"J"} & 0.01470 \end{pmatrix} \cdot\text{L}$$

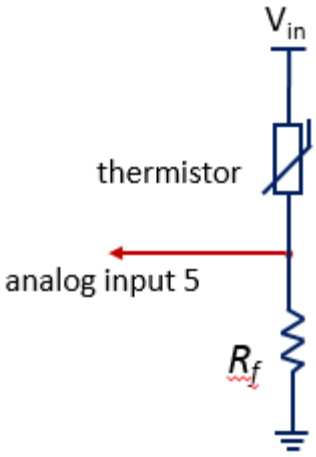
18. (5 points) A thermistor circuit is set up on an Arduino as shown below. The resistance value of the thermistor is $R_{th} = 3000\Omega$. The value of the analogRead(5) function is closest to:



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 567 \\ \text{"B"} & 592 \\ \text{"C"} & 617 \\ \text{"D"} & 641 \\ \text{"E"} & 666 \\ \text{"F"} & 689 \\ \text{"G"} & 714 \\ \text{"H"} & 738 \\ \text{"I"} & 762 \\ \text{"J"} & 786 \end{pmatrix}$$

19. (5 points) A thermistor circuit is set up as shown on an Arduino using the input voltage from the power supply as a source instead of the regulated 5V pin. The resistance value of the thermistor is $R_{th} = 13123\Omega$ and the usual 10k Ω resistor has been replaced with a resistor, $R_f = 6120\,\Omega$. The Arduino registers an analogRead(4) $\text{value} = 790$. The value of the input voltage source is closest to:

Hint: the analog pins use 5V as a reference, regardless of how the external circuits are connected. Your V_{in} may be much larger than 5V.



$$\text{Choices} = \begin{pmatrix} \text{"A"} & 9.90 \\ \text{"B"} & 10.28 \\ \text{"C"} & 10.64 \\ \text{"D"} & 11.03 \\ \text{"E"} & 11.40 \\ \text{"F"} & 11.77 \\ \text{"G"} & 12.14 \\ \text{"H"} & 12.52 \\ \text{"I"} & 12.88 \\ \text{"J"} & 13.27 \end{pmatrix} \cdot \text{V}$$

20. (5 points) Dr. Harbour recently purchased a Keurig coffee machine for his office. It makes a nice cup of coffee, but the cup it makes is too hot for his taste. Fortunately, Dr. Harbour keeps a supply of french vanilla creamer in his offce refrigerator that he uses to cool the coffee down to a suitable temperature. If the temperature of the initial cup of coffee is $\text{temp\_initial} = 94$ °C and the temperature of the final (suitable) cup of coffee is $\text{temp\_final} = 89$ °C, then the amount of creamer at a temperature of $\text{temp\_cream} = 4.1$ °C that Dr. Harbour has to add is closest to:

Assumptions:
- Cp for coffee = 4180 J/kg °C
- Cp for french vanilla creamer = 3770 J/kg °C
- Mass of coffee = $\text{mass\_coffee} = 504$ g
- no heat loss from the mug

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 25.85 \\ \text{"B"} & 26.87 \\ \text{"C"} & 27.83 \\ \text{"D"} & 28.85 \\ \text{"E"} & 29.86 \\ \text{"F"} & 30.90 \\ \text{"G"} & 31.90 \\ \text{"H"} & 32.91 \\ \text{"I"} & 33.91 \\ \text{"J"} & 34.93 \end{pmatrix} \cdot \text{grams}$$

21. (5 points) You have volunteered to make your special punch for an upcoming party. Having made this punch before, you remember that it includes three ingredients: Orange Juice, Pineapple juice, and your secret ingredient. To impress your friends, you decide to mix your punch at the party, using your secret ingredient as the only cooling source. You have the following volumes of ingredients at the given temperatures. When all three ingredients are mixed together, the final temperature of the special punch is closest to: **Assume all ingredients have the same density as water.**

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 4.41 \\ \text{"B"} & 4.83 \\ \text{"C"} & 5.26 \\ \text{"D"} & 5.68 \\ \text{"E"} & 6.11 \\ \text{"F"} & 6.54 \\ \text{"G"} & 6.96 \\ \text{"H"} & 7.39 \end{pmatrix} \cdot °\text{C}$$

$\text{Volume\_Orange\_Juice} = 0.98\,\text{L}$	$\text{Orange\_Juice\_Temperature} = 25$ °C
$\text{Volume\_Pineapple\_Juice} = 0.98\,\text{L}$	$\text{Pineapple\_Juice\_Temperature} = 26$ °C
$\text{Volume\_Secret\_Ingredient} = 0.75\,\text{L}$	$\text{Secret\_Ingredient\_Temperature} = -81$ °C

C_p of Orange Juice: 3730 J/kg °C

C_p of Pineapple Juice: 3770 J/kg °C

C_p of Secret Ingredient: 2300 J/kg °C

22. (5 points) The flash is running in the Boston Marathon. This year there is a super hero category because it would be unfair for him to compete against normal humans. To warm-up, the flash decide to run a few laps around the city. The soles on Flash's boots got a little warm and is setting any grass he steps on, on fire. Luckily, Aquaman is there to help out and brings a bucket of water to help lower the temperature of the Flash's boots. The 1.4 kg boot has an initial $\text{temperature} = 500 \cdot °C$ before it enters the 15L of water initially at 15 ºC. If the final temperature of the water with the boot is 70 ºC, what is the specific heat of the boot? (Assume none of the water vaporizes when the boot is placed in the water.)

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 4684 \\ \text{"B"} & 5030 \\ \text{"C"} & 5381 \\ \text{"D"} & 5728 \\ \text{"E"} & 6076 \\ \text{"F"} & 6424 \\ \text{"G"} & 6772 \\ \text{"H"} & 7126 \end{pmatrix} \cdot \frac{J}{kg \cdot °C}$$

23. (5 points) A city wide blackout has just knocked out power in Ruston and the power company says that it will be a some time before power is restored. You are worried that all the ice cream you just purchased for your Mardi Gras party will melt if the power does not come on soon. Your ice cream, with a total mass of 30 kg, is in the freezer and has an initial temperature of -10 ºC. You know that at 2 ºC the ice cream will start to melt and will lose its taste and texture. If the freezer (which has no power running to it) is *gaining* heat at a constant $\text{rate} = 18 \cdot W$, the time until the ice cream is ruined (i.e. begins to melt) is closest to:

(Assume the ice cream has a specific heat capacity of 3562 J/(kg ºC). Assume that nobody opens the freezer.)

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 16.2 \\ \text{"B"} & 17.4 \\ \text{"C"} & 18.6 \\ \text{"D"} & 19.8 \\ \text{"E"} & 21.0 \\ \text{"F"} & 22.2 \\ \text{"G"} & 23.4 \\ \text{"H"} & 24.6 \end{pmatrix} \cdot hr$$

24. (5 points) Your fishtank has a diameter of 1.6 inches and a depth of 2 inches. Your fishtank is initially filled water at $\text{temperature} = 20.1 \cdot °C$. Your 20 Ω fishtank heater is connected to a 12 V source. If you want the final temperature of the water to $\text{be} = 22.2 \cdot °C$, then the time the heater should be left on is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 46.27 \\ \text{"B"} & 51.08 \\ \text{"C"} & 56.02 \\ \text{"D"} & 60.77 \\ \text{"E"} & 65.69 \\ \text{"F"} & 70.54 \\ \text{"G"} & 75.45 \\ \text{"H"} & 80.34 \\ \text{"I"} & 85.20 \end{pmatrix} \text{ s}$$

25. (5 points) You have designed the perfect taco. Each taco must have a warm flour tortilla with a layer of fine ground beef, imported sharp cheddar, and a dollop of sour cream. With extensive research you have found that the temperature of the taco is very important and when everything is combined the final temperature of the taco should be $\text{temperature} = 41 \cdot °C$. The specific heat capacities and initial temperatures of all the ingredients are listed below. The masses of all the ingredients (except the beef) are listed below.

If 60% of the cost in making the taco is the beef (which is purchased at $9/kg), how much would you have to sell them to make a 20% profit (i.e. you sell the tacos at 1.2 times the raw cost to produce the taco)?

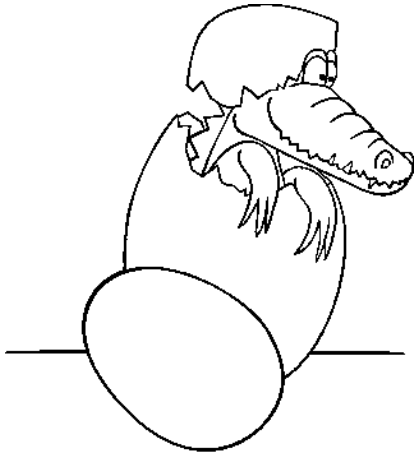
Ingredient	Mass (kg)	C_P (J/kg °C)	Initial Temperature (°C)
Beef	???	2000	94
Tortilla	0.04	1789	50
Cheese	0.12	3892	10
Sour cream	0.023	2388	10

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 2.16 \\ \text{"B"} & 2.32 \\ \text{"C"} & 2.48 \\ \text{"D"} & 2.64 \\ \text{"E"} & 2.80 \\ \text{"F"} & 2.96 \\ \text{"G"} & 3.12 \\ \text{"H"} & 3.28 \end{pmatrix} \cdot \text{dollars}$$

27. (5 points) Dr. Reis is in the process of starting his own alligator farm and already has a batch of eggs that were laid just a couple of days ago. To ensure that he gets a good male-to-female ratio, Dr. Reis uses his knowledge of alligator embryology. He knows that eggs incubated at 34°C will hatch only males and eggs incubated at 30°C will hatch only females.

So Dr. Reis puts 15 "male" eggs in one incubator and 60 "female" eggs in a different incubator. The eggs must stay in the incubators for 3 days. The eggs he received are all currently at 25°C. The heat capacity and mass of the eggs (regardless of sex) are shown below. Each incubator loses heat at a rate shown by the expression below (same rate for male and female eggs). The total amount of energy Dr. Reis needs in order to incubate his eggs to get the desired clutch of alligator offspring is closest to:

$$Cp_{egg} = 3200\,K\cdot\frac{J}{kg\cdot°C} \qquad mass_{egg} = 85\cdot grams \qquad heat_{loss} = 0.00042\,W + mass_{eggs\_total}\cdot 0.22\,\frac{W}{kg}$$



$$Choices = \begin{pmatrix} "A" & 452.703 \\ "B" & 482.066 \\ "C" & 511.326 \\ "D" & 540.648 \\ "E" & 570.196 \\ "F" & 598.881 \\ "G" & 628.238 \\ "H" & 657.868 \\ "I" & 687.715 \end{pmatrix}\cdot kJ$$

The questions in this exam do not reflect the views or thoughts of the editor of this exam.

While you are waiting to begin your test:

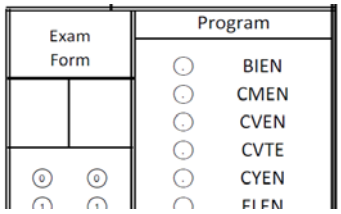
Bubble:	For Course Section:	
01	001 - Corbett	TR 10-11:50
02	002 - Reis	TR 4-5:50

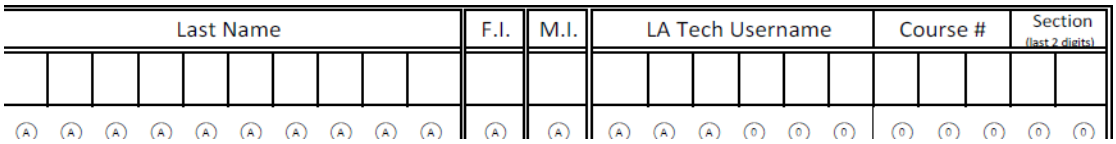
- Please write and bubble your name and initials on your response sheet
- Please write and bubble your LATech username (e.g. abc567) on your response sheet
- Please write and bubble your section number on your response sheet using the guide shown here
- Please write and bubble your ExamForm number. This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

ExamForm= 21

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"**





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.
- Please note the reference information 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.

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

Density of water at 4°C (maximum density) =1kg/L = 1 g/mL = 1g/cm^3 = 1000 kg/m^3 = 8.33 lbs/gal

$$C_{p\,H_2O} = 4180\frac{J}{kg \cdot C}$$

1L = 0.001m^3 = 1.0567quarts = 0.264gal = 61.02in^3 1 gal = 0.1337 ft^3 = 3.785 L

1 pound = 16 ounces = 453.592 grams 1 inch = 25.4 mm 1 foot = 12 inches

Conductivity Sensor Reactions:

$2Cl^-_{(aq)} \longrightarrow Cl_{2\,(g)} + 2e^-$ and $2H_20_{(l)} + 2e^- \longrightarrow H_{2\,(g)} + 2OH^-_{(aq)}$

Atomic Weights:

Na = 23.0 g/mol, Cl = 35.5 g/mol, C = 12.0 g/mol, H = 1.0 g/mol, O = 16.0 g/mol

$$V \cdot I \cdot t = \rho \cdot Vol \cdot C_p \cdot \Delta T$$

Volume of Cylinder = $\frac{\pi \cdot diameter^2}{4} \cdot height$ $\Delta E = Q - W$

181 ENGR121 E1 - Section 001 Redesign Pilot Group

ExamForm = 21 ind = 1

Key =

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