Name:_____ Instructor:_____ ENGR 121 - Exam 2
Section:_____ February 22, 2018

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

ExamForm := 11

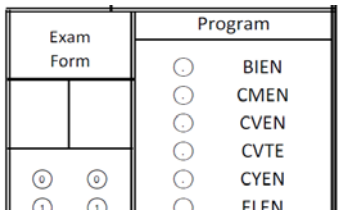
Honor Statement: *On my honor, I promise that I have not received any unauthorized assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, I didn't use an unauthorized calculator, I didn't use any 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 - Easley	TR 8-9:50
92	H02 - Cronk	TR 2-3:50
93	H03 - Swanbom	MW 2-3:50
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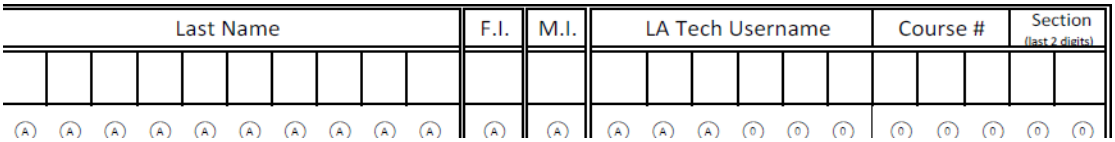
05	005 - Scoggin	MW 12-1:50
06	006 - Bhattarai	TR 4-5:50



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

2. (3 points) _____ is the difference between the upper contol limit (UCL) and the lower control limit (LCL) of the fishtank system.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"Deadband"} \\ \text{"B"} & \text{"Hysteresis"} \\ \text{"C"} & \text{"Difference band"} \\ \text{"D"} & \text{"Error"} \\ \text{"E"} & \text{"Target zone"} \\ \text{"F"} & \text{"Setpoint"} \\ \text{"G"} & \text{"Deadtime compensation"} \\ \text{"H"} & \text{"Gain"} \end{pmatrix}$$

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

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"Resistor"} \\ \text{"B"} & \text{"Solenoid Valve"} \\ \text{"C"} & \text{"Capacitor"} \\ \text{"D"} & \text{"Transformer"} \\ \text{"E"} & \text{"Thermistor"} \\ \text{"F"} & \text{"Transistor"} \\ \text{"G"} & \text{"Diode"} \\ \text{"H"} & \text{"Relay"} \end{pmatrix}$$

4. (3 points) When salty or DI water is added to a fishtank system through the solenoid valves, you should avoid adding either salty or DI water again until after mixing of the water has been completed (until the salinity stops changing due to mixing). That is, you should wait until the _____ has passed before adding either salty or DI water to correct any error in the salinity.

Choices =

"A"	"lower control limit"
"B"	"target concentration"
"C"	"gain"
"D"	"deadtime compensation"
"E"	"upper control limit"
"F"	"deadband"
"G"	"setpoint"
"H"	"error"

5. (3 points) _____ is the fraction of error that we wish to correct when your fishtank system reads a value above the UCL or below the LCL.

Choices =

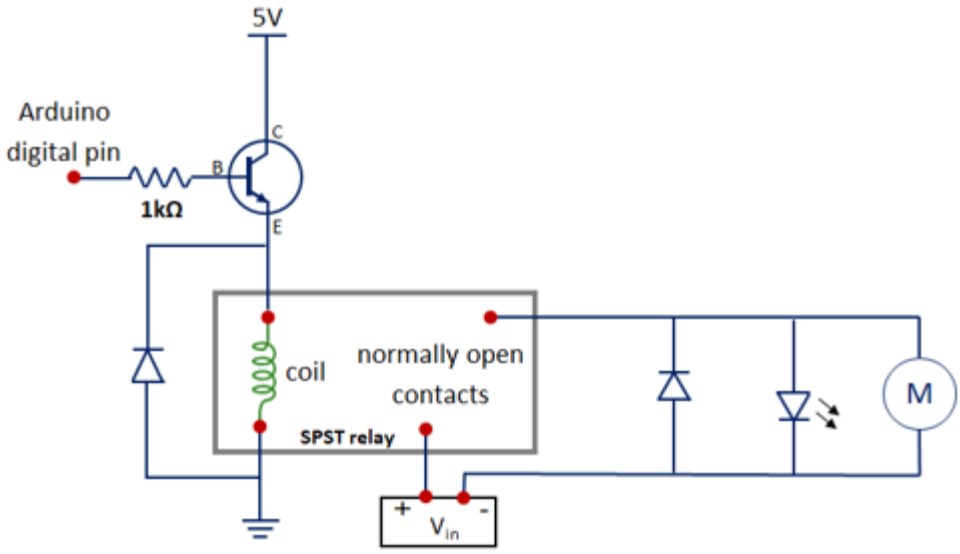
"A"	"Deadtime compensation"
"B"	"Setpoint"
"C"	"Target zone"
"D"	"Gain"
"E"	"Error"
"F"	"Upper control limit"
"G"	"Deadband"
"H"	"Difference band"

6. (3 points) In the circuit below, what will happen when the voltage at the Arduino digital pin goes “HIGH”?

I. Conventional electrical current will flow from the collector to the emitter of the transistor.
II. Conventional electrical current will flow from the emitter to the collector of the transistor.
III. The relay coil will become energized, closing the relay contacts.
IV. The relay coil will become energized, opening the relay contacts.
V. The LED will begin to emit light.
VI. The shaft of the DC motor will begin to spin.

Choices =

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



7. (3 points) You are evaluating the salinity control system of your fishtank project. The reading displays a value greater than your setpoint but less than the UCL. According to the procedure discussed in class, what should your fishtank do?

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"Turn on the pump."} \\ \text{"B"} & \text{"There is not enough information to know what the system should do."} \\ \text{"C"} & \text{"Open the “salty water” solenoid valve"} \\ \text{"D"} & \text{"Open the “salty water” and “DI water” solenoid valves simultaneously."} \\ \text{"E"} & \text{"Your system should do nothing."} \\ \text{"F"} & \text{"Open the “DI water” solenoid valve."} \\ \text{"G"} & \text{"Close the “Di water” solenoid valve."} \\ \text{"H"} & \text{"Close the “salty water” solenoid valve."} \end{pmatrix}$$

8. (3 points) Why were transistor and relay circuits used to control the flow of electrical power to the heater and solenoid valves in your fishtank project?

I. The Arduino is incapable of providing large enough currents to actuate (open) the solenoid valves.
II. To make the system harder to correctly implement.
III. The Arduino is incapable of providing enough current to cause the heater to warm up sufficiently.
IV. Because your instructor is mean.
V. To increase the efficiency of the pump.
VI. To increase the current supplied to the pump.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"II, IV, V, \& VI"} \\ \text{"B"} & \text{"I \& III only"} \\ \text{"C"} & \text{"I, II, IV, \& V"} \\ \text{"D"} & \text{"only VI"} \\ \text{"E"} & \text{"II, V, and VI"} \\ \text{"F"} & \text{"IV \& VI"} \\ \text{"G"} & \text{"I, \& V only"} \\ \text{"H"} & \text{"II \& V"} \end{pmatrix}$$

9. (3 points) The equation for salinty written in terms of the analog output provided by the conductivity sensor is given below. Assuming **val** is defined as an ***int*** earlier in the sketch, how would you type the salinity equation in your Arduino sketch to correctly calculate the salinity value?

$$\text{salinty} = 3.6686\,(10)^{-24}\cdot \text{val}^{7.5472}$$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"float salinity = 3.6686*10^-24*val^7.5472"} \\ \text{"B"} & \text{"float salinity = 3.6686*(10,-24)*(val, 7.5472)"} \\ \text{"C"} & \text{"float salinity = 3.6686*exp(10,-24)*exp(val, 7.5472)"} \\ \text{"D"} & \text{"long salinity = 3.6686*pow(10)^24*pow(val)^7.5472"} \\ \text{"E"} & \text{"long salinity = 3.6686*exp(10,-24)*exp(val, 7.5472)"} \\ \text{"F"} & \text{"int salinity = 3.6686^-24*val^7.5472"} \\ \text{"G"} & \text{"float salinity = 3.6686*pow(10,-24)*pow(val, 7.5472)"} \\ \text{"H"} & \text{"int salinity = 3.6686*pow(10,-24)*pow(val, 7.5472)"} \end{pmatrix}$$

10. (3 points) You are evaluating the temperature control on your fish tank. The first temperature reading displays a temperature less than your LCL. The heater turns on. The next temperature reading displays a value between your LCL and UCL. According to the procedure discussed in class, what should your heater do?

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"turn off until reading are below the LCL"} \\ \text{"B"} & \text{"turn off when readings are exactly at the setpoint"} \\ \text{"C"} & \text{"stay on until readings are below the LCL"} \\ \text{"D"} & \text{"stay on until the readings are above the UCL"} \\ \text{"E"} & \text{"turn off until readings are above the UCL"} \\ \text{"F"} & \text{"stay on until readings are exactly at the setpoint"} \\ \text{"G"} & \text{"oscillate on and off when readings are at the setpoint"} \\ \text{"H"} & \text{"not enough informaiton"} \end{pmatrix}$$

11. (3 points) The fishtank system for a group of ENGR 121 students has a $\text{setpoint} = 0.08\%$, $\text{UCL} = 0.11\%$, and $\text{LCL} = 0.06\%$. If the current salinity reading $\text{is} = 0.05\%$, then the error is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.025 \\ \text{"B"} & 0.026 \\ \text{"C"} & 0.028 \\ \text{"D"} & 0.030 \\ \text{"E"} & 0.032 \\ \text{"F"} & 0.034 \\ \text{"G"} & 0.035 \\ \text{"H"} & 0.037 \end{pmatrix} \cdot \%$$

12. (5 points) Assume you have the amount of water shown below added to 0.5 kg of NaCl. The weight percentage of NaCl in the mixture is closest to:

$\text{Water} = 15\,\text{kg}$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 3.030 \\ \text{"B"} & 3.226 \\ \text{"C"} & 3.422 \\ \text{"D"} & 3.618 \\ \text{"E"} & 3.814 \\ \text{"F"} & 4.007 \\ \text{"G"} & 4.208 \\ \text{"H"} & 4.405 \end{pmatrix} \cdot \%$$

13. (5 points) If a constant current of $I_{CS} = 0.13A$ passes through the probes of a conductivity sensor for a time of $time = 8 \cdot hr$, what mass of H_2 will be formed (in milligrams) if the atomic weight of H_2 = 2.015 g/mol?

$$Choices = \begin{pmatrix} "A" & 23.341 \\ "B" & 27.246 \\ "C" & 31.192 \\ "D" & 35.147 \\ "E" & 39.086 \\ "F" & 43.024 \\ "G" & 46.979 \\ "H" & 50.900 \end{pmatrix} \cdot mg$$

14. (5 points) If the number of Cl_2 gas molecules shown below are formed over a time of 25 seconds, the current passing through the probes of a conductivity senser is closest to:

$$Cl2Molecules = 2.24 \times 10^{16}$$

$$Choices = \begin{pmatrix} "A" & 0.217 \\ "B" & 0.235 \\ "C" & 0.252 \\ "D" & 0.270 \\ "E" & 0.287 \\ "F" & 0.305 \\ "G" & 0.322 \\ "H" & 0.339 \end{pmatrix} \cdot mA$$

15. (5 points) If a resistive heater is supplied a voltage of $V_s = 9V$ and will consume $E = 117J$ of energy in $time = 10s$, then the minimum current that the power supply should be rated for it to work with this heater is closest to:

$$Choices = \begin{pmatrix} "A" & 1.17 \\ "B" & 1.23 \\ "C" & 1.30 \\ "D" & 1.37 \\ "E" & 1.43 \\ "F" & 1.50 \\ "G" & 1.56 \\ "H" & 1.63 \end{pmatrix} \cdot A$$

16. (5 points) Ethylene glycol is commonly mixed with water, and together these two components are called antifreeze. Antifreeze is the liquid used in a car's cooling systems to keep the engine from overheating. For the climate in Louisiana, the recommended concentration of ethylene glycol in a car's cooling system is $C = 18.5\cdot\%$ by weight (the rest of the antifreeze is water).

If the fluid level of the antifreeze in your car is low and missing a $\text{volume} = 500\cdot\text{cm}^3$ of antifreeze, then the amount of ethylene glycol that needs to be mixed with water to achieve the recommended concentration is closest to:

$$\rho_{\text{ethyleneGlycol}} = 1113\,\frac{\text{kg}}{\text{m}^3} \qquad \rho_{\text{antifreeze}} = 1019\,\frac{\text{kg}}{\text{m}^3}$$

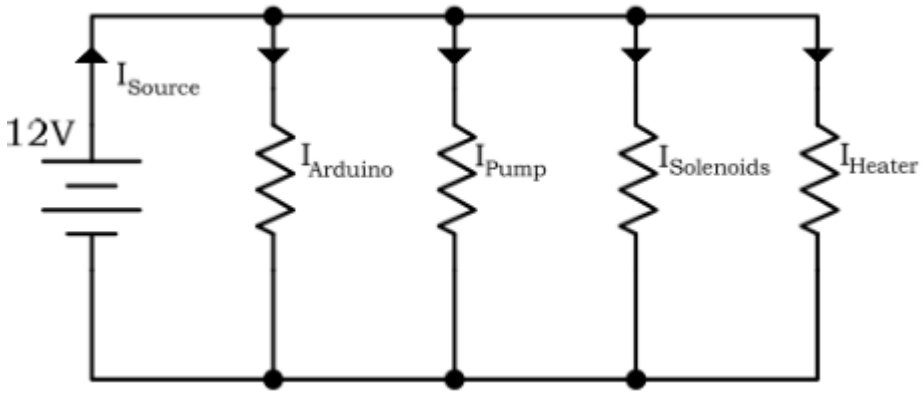
$$\text{Choices} = \begin{pmatrix} \text{"A"} & 58.82 \\ \text{"B"} & 63.12 \\ \text{"C"} & 67.49 \\ \text{"D"} & 71.74 \\ \text{"E"} & 76.06 \\ \text{"F"} & 80.38 \\ \text{"G"} & 84.69 \\ \text{"H"} & 88.97 \end{pmatrix} \cdot \text{cm}^3$$

17. (5 points) You have finally been given your family's secret sweet tea recipe. If the recipe calls for a mass of $\text{sugar} = 100\cdot\text{gm}$ and a mass of lemon $\text{juice} = 125\cdot\text{gm}$ to be added to a $\text{volume} = 1\cdot\text{gal}$ of unsweet tea, what is the final concentration by weight of the sugar in the sweet tea? The density of unsweet tea is $\rho_t = 1004\,\frac{\text{kg}}{\text{m}^3}$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 1.98 \\ \text{"B"} & 2.11 \\ \text{"C"} & 2.23 \\ \text{"D"} & 2.36 \\ \text{"E"} & 2.48 \\ \text{"F"} & 2.61 \\ \text{"G"} & 2.73 \\ \text{"H"} & 2.86 \end{pmatrix} \cdot \%$$

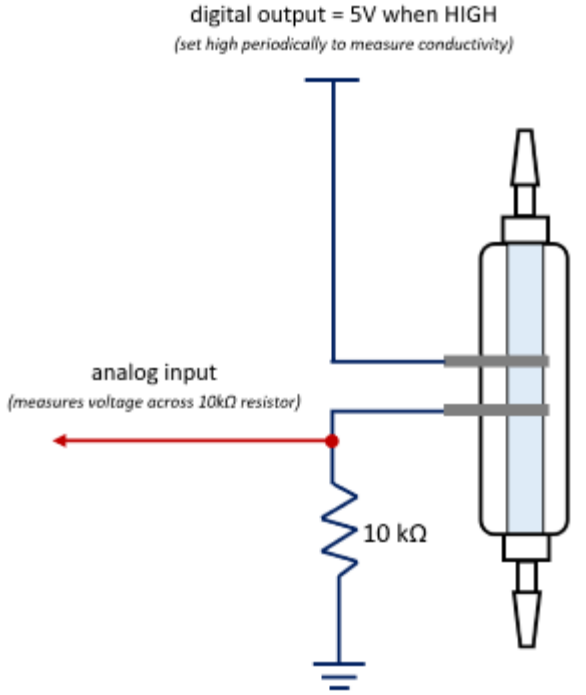
18. (5 points) In the fishtank project the 12V power adapter supplies power to the Arudino, the pump, the solenoid valves, and the heater (the Arduino supplies the power for the relays, temperature sensor, and the conductivity sensor). If the Arduino, pump, solenoid valves, and the heater are modeled as resistors and the current drawn by these components is as shown below, then what is the current supplied by the 12 V source ?

$I_{Arduino} = 0.175\,A$ $I_{Solenoids} = 0.05\,A$ $I_{Heater} = 0.5\,A$ $I_{Pump} = 0.2\,A$



$$Choices = \begin{pmatrix} "A" & 0.832 \\ "B" & 0.925 \\ "C" & 1.018 \\ "D" & 1.112 \\ "E" & 1.204 \\ "F" & 1.297 \\ "G" & 1.390 \\ "H" & 1.483 \\ "I" & 1.579 \\ "J" & 1.669 \end{pmatrix} A$$

19. (5 points) If the number of chlorine gas molecules produced at the anode of a conductivity sensor is listed below, then the current flowing through the 10 kΩ resistor is closest to?



$$Molecules_{chlorine} = 35 \times 10^{18} \cdot \frac{1}{min}$$

$$Choices = \begin{pmatrix} "A" & 0.1494 \\ "B" & 0.1870 \\ "C" & 0.2245 \\ "D" & 0.2620 \\ "E" & 0.2995 \\ "F" & 0.3370 \\ "G" & 0.3746 \\ "H" & 0.4120 \\ "I" & 0.4497 \\ "J" & 0.4871 \end{pmatrix} \cdot A$$

20. (5 points) What error would result in a target $\text{salinity} = 0.311 \cdot \%$ NaCl by weight if the current salinity is measured to be 0.750% NaCl by weight and the system gain is set to 65%?

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.593 \\ \text{"B"} & 0.635 \\ \text{"C"} & 0.675 \\ \text{"D"} & 0.716 \\ \text{"E"} & 0.757 \\ \text{"F"} & 0.798 \\ \text{"G"} & 0.839 \\ \text{"H"} & 0.881 \\ \text{"I"} & 0.922 \\ \text{"J"} & 0.962 \end{pmatrix} \cdot \%$$

21. (5 points) In a paper mill, wet paper entering the felt section contains water along with 20% solids by weight. A coloring solution is added to the paper in the felt section at a $\text{rate}_{\text{color}} = 75 \frac{\text{kg}}{\text{min}}$ consisting of 10% solids and 90% water by weight. The felt section removes water from the paper and also outputs 1500 kg of wet paper per minute (consisting of solids and $\text{water} = 62 \cdot \%$). The rate that the wet paper enters the felt section is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 1668 \\ \text{"B"} & 1810 \\ \text{"C"} & 1956 \\ \text{"D"} & 2098 \\ \text{"E"} & 2244 \\ \text{"F"} & 2386 \\ \text{"G"} & 2527 \\ \text{"H"} & 2670 \\ \text{"I"} & 2813 \\ \text{"J"} & 2955 \end{pmatrix} \cdot \frac{\text{kg}}{\text{min}}$$

22. (5 points) The 0.15% wt NaCl water tank in the freshman lab is low and currently only has a $\text{mass} = 18.34\text{kg}$. A student sees a bucket that has a mass of 25kg of salty water, and he pours it into the tank. Unfortunately, the student realizes too late that the bucket had 0.1% wt NaCl. The new % wt of NaCl for the water in the tank is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.077 \\ \text{"B"} & 0.084 \\ \text{"C"} & 0.092 \\ \text{"D"} & 0.099 \\ \text{"E"} & 0.106 \\ \text{"F"} & 0.114 \\ \text{"G"} & 0.121 \\ \text{"H"} & 0.129 \\ \text{"I"} & 0.136 \end{pmatrix} \cdot \%$$

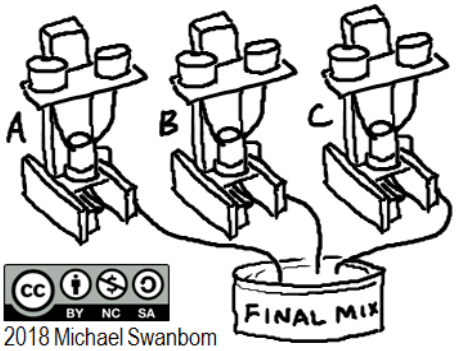
23. (5 points) A plant produces skim milk. The process begins with whole milk that has a fat $\text{content} = 4.952\%$ and a content of $\text{water} = 85.405\%$. The process removes some of the milk that contains $\text{fat} = 90\cdot\%$ and $\text{water} = 9\cdot\%$ and the final output of skim milk contains $\text{fat} = 0.1\%$, $\text{Water} = 90.9\%$ and proteins and carbohydrates in the $\text{amount} = 9\cdot\%$. If the whole milk enters at a rate of 20 kg/min, then the rate that the skim milk is produced is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 13.159 \\ \text{"B"} & 14.137 \\ \text{"C"} & 15.086 \\ \text{"D"} & 16.046 \\ \text{"E"} & 16.993 \\ \text{"F"} & 17.957 \\ \text{"G"} & 18.921 \\ \text{"H"} & 19.878 \end{pmatrix} \cdot \frac{\text{kg}}{\text{min}}$$

24. (5 points)You own an outdoor pool that has a volume of $\mathrm{Vol}_{\mathrm{pool}} = 120 \cdot \mathrm{m}^3$. You converted your pool into an outdoor aquarium for sea creatures, and therefore you must maintain the salinity of the water at 3.5%. Last night it rained, and you forgot to cover the aquarium. When you checked the salinity this morning, you found that the current salinity of water in the $\mathrm{aquarium} = 1.8 \cdot \%$. Fortunately, you have a large quantity of premixed brine that is 5% salt by weight. How much of the brine must you add, if the water leaving the tank through the overflow valve can be assumed to consist of 20% of the brine and 80% of the aquarium water that resulted after the rain?

$$\mathrm{Choices} = \begin{pmatrix} \text{"A"} & 59376.3 \\ \text{"B"} & 63548.9 \\ \text{"C"} & 67555.7 \\ \text{"D"} & 71563.5 \\ \text{"E"} & 75646.0 \\ \text{"F"} & 79687.5 \\ \text{"G"} & 83745.5 \\ \text{"H"} & 87780.1 \end{pmatrix} \cdot \mathrm{kg}$$

25. (5 points) Three freshman project groups have been running their conductivity sensors for long periods of timecausing hydroxide (OH^-) to build up significantly in their saltwater systems. *(All of the chlorine and hydrogen gas that may have also been produced has vented to the atmosphere and dissipated.)*



All three groups drain the water from their systems into the same container, and the resulting mixture is = 829 grams of solution that has concentrations listed under "Final Mix" in the table below (by weight). The concentrations of each of the groups' initial mixtures are also given in the table. If the amount of mass Group A contributes is $m_A = 420.842\text{gm}$, then the amount of mass that Group B drained into the final mixture is closest to:

Choices = $\begin{pmatrix} \text{"A"} & 134.3 \\ \text{"B"} & 145.1 \\ \text{"C"} & 156.0 \\ \text{"D"} & 166.8 \\ \text{"E"} & 177.6 \\ \text{"F"} & 188.4 \\ \text{"G"} & 199.2 \\ \text{"H"} & 210.0 \\ \text{"I"} & 220.7 \end{pmatrix} \cdot \text{grams}$

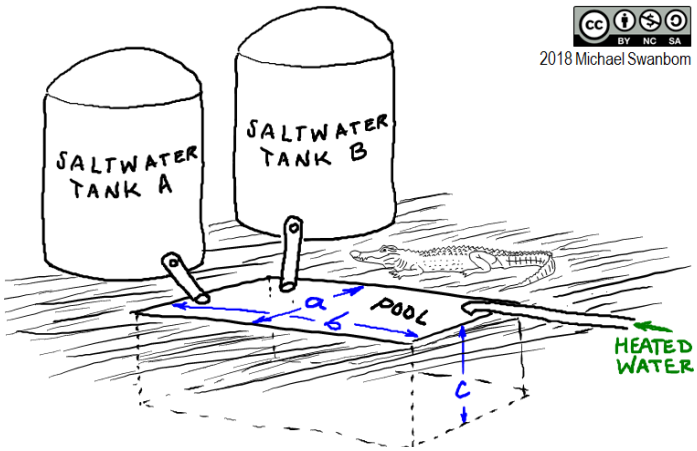
concentrations =

""	"Group A"	"Group B"	"Group C"	"Final Mix"
"Salt"	0.141	0.132	0.094	0.126
"Hydroxide"	0.045	0.005	0.083	0.047
"Water"	99.814	99.863	99.823	99.827

$\cdot\%$

Note that all of the values given in the table are percentages!

26. & 27. (2.5 points each) Dr. Pathak has just completed his in-ground pool for his pet alligator Nanoe. He would like to fill the rectangular pool (dimensions given below) to the very top with saltwater with a concentration = 1.6·% and a temperature = 31 degC. He has two saltwater tanks; tank A is = 5.1·% salt at = 12 degC and tank B has = 0.4·% salt at = 22 degC. He also has a supply of DI water heated to = 55 degC. He will use a combination of the three sources to make the water just right for Nanoe. The volumes that should be added to the pool from each tank are closest to:



Note: Assume all water, regardless of salt concentration, has the density and specific heat capacity of DI water Assume zero heat loss or gain from the pool's surroundings.

Pool Dimensions:

$a = 2.5 \cdot m \quad b = 4.1 \cdot m \quad c = 0.9 \cdot m$

$$FromTankA_{prob26} = \begin{pmatrix} "A" & 1837.7 \\ "B" & 1999.1 \\ "C" & 2157.2 \\ "D" & 2317.3 \\ "E" & 2477.1 \\ "F" & 2637.5 \\ "G" & 2798.1 \\ "H" & 2959.1 \\ "I" & 3116.3 \end{pmatrix} \cdot L \qquad FromTankB_{prob27} = \begin{pmatrix} "A" & 2678.3 \\ "B" & 2873.8 \\ "C" & 3073.9 \\ "D" & 3272.4 \\ "E" & 3470.7 \\ "F" & 3671.1 \\ "G" & 3867.6 \\ "H" & 4064.6 \\ "I" & 4266.6 \end{pmatrix} \cdot L$$

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

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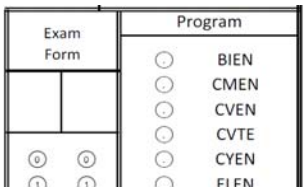

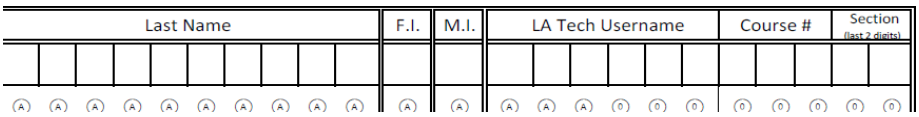

Also Note:

- 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) = 1 g/mL = 1g/cm³ = 1000 kg/m³ = 8.33 lbs/gal

$C_{p\,H_2O} = 4180\frac{J}{kg \cdot C}$ $1ton = 2000lb$

1L = 0.001m³ = 1.0567quarts = 0.264gal = 61.02in³ 1 gal = 0.1337 ft³ = 3.785 L

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

$°C = \frac{5}{9} \cdot (°F - 32)$

$°F = \frac{9}{5} \cdot °C + 32$

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

$R = \frac{\rho \cdot L}{A}$ $\alpha = \frac{R_2 - R_1}{R_1(T_2 - T_1)}$ $V \cdot I \cdot t = \rho \cdot Vol \cdot C_p \cdot \Delta T$

Volume of Cylinder = $\frac{\pi \cdot diameter^2}{4} \cdot height$ $\Delta E = Q - W$ $V_{sphere} = \frac{4}{3}\pi \cdot r^3$

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ExamForm = 11 ind = 1

Key =

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