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| **1st period** | | | | |
| **Group** | **Summary** | **Items Mentioned** | **Comments** | **Grade** |
| 1 | * Error with thermometer * Didn’t record the highest temp because didn’t wait long enough. * Made ΔT too low. * Made C too low. * C = 0.338 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that not waiting long enough makes ΔT too low. * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 2 | * Didn’t stir water well * Hot spots in cup * ΔT too low * No C value reported from presenter (C=0.5908) | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** NO | * Good identifying sources of error * No mention of how C was changed. * C value not correctly calculated in notebook by presenter | 3/10 |
| 3 | * Didn’t boil brass long enough * Used too much water in cup * Didn’t stir water in cup * C = 0.238 | **Source of Error –** Yes  **Variables Changed –** NO  **Direction Variables are Changed –** NO  **Directional Impact on C –** NO | * Good listing many sources of error * No mention of how the variables were actually changed. Simply saying they *were* changed is not enough. | 3/10 |
| 4 | * Trial one was faulty * Thermometer broke * Had to wait for new thermometer * While waiting water cooled down * Tf was too low * ΔT therefore to low * Too low of C * C = 0.304 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that ΔT too low. * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 5 | * ΔT wrong – brass not on hot plate long enough * Holes in cup let heat out * ΔT and Q changed * C = 0.609 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** NO  **Directional Impact on C –** NO | * Correct that ΔT and Q are changed * Correct that ΔT too low seemed to be the source of error – too small ΔT does make C too large BUT you did not mention that ΔT was too low and C was therefore too large! * No mention of how that would change variables or specific heat | 3/10 |
| 6 | * Brass not in boiling water long enough. * Didn’t wait long enough in the cup * ΔT therefore too low * C therefore too low * C = 0.348 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that not waiting long enough makes ΔT too low. * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 7 | * Measured mass of water wrong * m therefore too high * therefore Q is changed * C = 0.293 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** NO | * Correct that m and Q would be changed * Good in that m being too high would make C too small – so that supports your result BUT you didn’t explain that! * No mention of how that would change specific heat | 5/10 |
| 8 | * Loss of water due to transferring * m too low * C too low * C = 0.359 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that m would be too small BUT if m is too low then C is too HIGH C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |

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| **2nd period** | | | | |
| **Group** | **Summary** | **Items Mentioned** | **Comments** | **Grade** |
| 1 | * Took too long transferring from boiling water to cup * ΔT too small * Changed Q * C = 0.332 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** NO | * Correct that not waiting long enough makes ΔT too low. * Change to C not mentioned * Incorrect source of error- If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 3/10 |
| 2 | * Boiling water temperature was not up to 100C * Q affected * ΔT too small * C too high * C = 0.395 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Perfect! If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 10/10 |
| 3 | * Brass left for too short of a time * ΔT too low * C too low * C was not done correctly in presenter’s notebook. Other group member reported C = 0.453 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Good listing many sources of error * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. * You reported C was too low but your C was too high! | 3/10 |
| 4 | * Beaker to cup transition too slow * Brass cooled down during transfer * ΔT too low * Q too low * C too low * C = 0.37 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that too long of a transfer makes ΔT too low. * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 5 | * Beaker to cup transition too slow * Brass cooled down during transfer * ΔT too low * Q too low * C too low * C = 0.287 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that too long of a transfer makes ΔT too low. * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 6 | * Didn’t leave brass in water long enough * ΔT too low * Q too low * C too low * C = 0.249 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that not leaving brass in water long enough makes ΔT too low * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 7 | * Boiling water was not at 100C * Affected Tf * MadeΔT too low * C too low * C = 0.327 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that water not being at 100C would make ΔT too low * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 8 | * Brass not in water long enough. * ΔT too low * C too low * Brass hollow – too much mass due to water * m too high * Q too low * C too low | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that brass not being in water long enough makes ΔT too low * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. * Correct that mass too high makes C too low | 7/10 |

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| **3rd period** | | | | |
| **Group** | **Summary** | **Items Mentioned** | **Comments** | **Grade** |
| 1 | * Didn’t stir water well enough * Made Tf too low * Made C too low * C = 0.3011 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that stirring water not well enough can make some areas too low in temp…BUT it can also make some areas too high in temp! * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 5/10 |
| 2 | * Didn’t heat brass long enough * Didn’t get brass to 100C * ΔT too high * Made C too low * Referenced the equation * C = 0.360 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Not heating brass long enough makes ΔT too low! * If your ΔT was too high then yes, C would be too low. BUT your ΔT was too low based on your source of error (If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large.) * Great job referencing equation! | 4/10 |
| 3 | * Had water on the brass before weighing * Made m too high * Made C too low * Referenced the equation * C = 0.334 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Great job referencing equation! * Correct identification of m being too high making C too low. | 10/10 |
| 4 | * Brass didn’t heat in the water long enough * Temperature of brass too low * ΔT too low * C too low * C = 0.347 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that not leaving brass in water long enough makes ΔT too low * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 5 | * Hot plate was not functioning * Did not get hot enough * Brass did not get hot enough * ΔT too low * C too low * C = 0.297 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that hot plate not being hot enough makes ΔT too low * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 6 | * Brass not in water long enough * ΔT too low * Q too low * C too low * C = 0.303 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that not leaving brass in water long enough makes ΔT too low * Careful with assumptions - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. If Q is too low then C is too low. So how do you know which had the bigger overall effect? Was a decrease in Q more impactful or decrease in ΔT more impactful??? | 8/10 |
| 7 | * Brass in water before it was weighed * m too high * C too low * C = 0.321 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct identification of m being too high making C too low. | 10/10 |
| 8 | * Water was not hot enough * ΔT too low * C too high * C = 0.414 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that if water was not hot enough ΔT would be too low. * Correct identification of ΔT being too low makes C too high | 10/10 |

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| **4th period** | | | | |
| **Group** | **Summary** | **Items Mentioned** | **Comments** | **Grade** |
| 1 | * Error was mass of brass – measured three times, once per trial. * Didn’t wait long enough – caused a “lower yield” * Affected temperature * 51mL only weighed 50 grams * m was too low * C = 0.36 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes & NO  **Directional Impact on C –** NO | * Correct that it was wrong to measure the brass three times. * There was not “yield” in this lab… * Not sure why you weighed the water…you should have used the density equation… * Correct that mass would be too low BUT that would make your C too big - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 3/10 |
| 2 | * m was too low * water plus brass in the cup was weighed and mass was rounded too low * made C too low * inaccurate with taking temperature – thermometer was touching brass – made m to low * Didn’t know which value was Cbrass in notebook…eventually found it and C = 0.291 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * VERY difficult to follow * If m was too low then that would make your C too big - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. * Need to understand the lab well enough that you know where to look to find your Cbrass when asked! | 2/10 |
| 3 | * Didn’t wait long enough in the water * ΔT and Q were changed * C was too low * C = 0.349 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** NO  **Directional Impact on C –** Yes | * Correct that not leaving brass in water long enough makes ΔT too low * Didn’t mention how ΔT changes * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 5/10 |
| 4 | * “human error” * Third trial – impatient * ΔT was “messed up” * C was too low * C = 0.336 “I think” | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** NO  **Directional Impact on C –** Yes | * “Human error” isn’t a “thing” ! * “Messed up” is not a direction! * You need to actually know what your result was… * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 3/10 |
| 5 | * “human error” * Measured the brass each time * Used a different amount of water each time * Changed ΔT * More molecules meant a different Temperature * ΔT ok * C = exact 0.380 | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** NO  **Directional Impact on C –** Yes | * “human error” is not a “thing” ! * You need SPECIFICS – saying something changed, saying a different amount, or different temperature doesn’t say anything. | 3/10 |
| 6 | * Didn’t leave brass in water long enough * Didn’t get brass to 100C * Lowered Tf * Lowered C | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Correct that not leaving brass in water long enough makes ΔT too low * Change to C incorrect - If ΔT is too low then C ends up too BIG. C = Q/(mΔT) 🡪 Dividing by a too small number makes your C too large. | 6/10 |
| 7 | * Mass of brass was too high because it had water left from earlier period * Because mass is proportional to ΔT and C 🡪 C was too low | **Source of Error –** Yes  **Variables Changed –** Yes  **Direction Variables are Changed –** Yes  **Directional Impact on C –** Yes | * Great job referencing equation! * Correct identification of m being too high making C too low. | 10/10 |
| 8 |  |  |  |  |