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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 |  |  |  |  |