Name_____ Period _____ Date _____

Bridge Metal STEM Sims

Lesson 5: Analyzing Tensile Strength Data

Tensile strength is a measure of how much pulling-apart stress a material can withstand before the material fails. Can you use a simple data analysis tool to better assess the tensile strength of various materials?

Doing the Science

1. Start the Bridge Metal Simulation by clicking on the "Sim" tab.
2. Click on the "Tensile Center" button.
3. Click the "New Sample" icon and choose "Sample #1."
4. Click once on the red-colored "Tension" lever.
5. Note and record in Table 1 the number appearing on the "Tensile-o-Matic 2012 machine. This is the amount of stress in megapascals (MPa) the material withstood before failing.
6. Click on "Reset" button.
7. Repeat steps 4 - 6 for a total of 20 trials.
8. Click the "New Sample" icon and choose "Sample #4."
9. Repeat steps 4 - 6 for a total of 20 trials for Sample #4.
10. Enter your Table 1 data into a spreadsheet.

Table 1.

Trials	**Sample 1 Breaking Point (MPa)**	**Trials**	**Sample 1 Breaking Point (MPa)**	**Trials**	**Sample 4 Breaking Point (MPa)**	**Trials**	**Sample 4 Breaking Point (MPa)**
1.		11.		1.		11.	
2.		12.		2.		12.	
3.		13.		3.		13.	
4.		14.		4.		14.	
5.		15.		5.		15.	
6.		16.		6.		16.	
7.		17.		7.		17.	
8.		18.		8.		18.	
9.		19.		9.		19.	
10.		20.		10.		20.	
Avg. 1- 10		Avg. 11- 20		Avg. 1- 10		Avg. 11- 20	
p =				*p* =			
p =							

11. Calculate and record in Table 1 the average breaking point for Sample 1's trials 1 – 10.
12. Repeat step 11 for Sample 1's trials 11 – 20.
13. Calculate and record in Table 1 the average breaking point for Sample 4's trials 1 – 10.
14. Repeat step 13 for Sample 4's trials 11 – 20.

15. Run a Student's *t*-test to compare the averages for Sample 1's trials 1 – 10 and trials 11 -20. Record the *p* value in Table 1.
16. Run a Student's *t*-test to compare the averages for Sample 4's trials 1 – 10 and trials 11 -20. Record the *p* value in Table 1.
17. Run a Student's *t*-test to compare the averages for Sample 1's trials 1 – 20 and Sample 4's trials 1 – 20. Record the *p* value in Table 1.

Do You Understand?

1. Were the average breaking stress values for Sample 1's trials 1 – 10 and trials 11 – 20 different? Please provide a reason for the different average values (if they existed).

2. Based on the *t*-test results for Sample 1's trials 1 – 10 and trials 11 – 20, were the average breaking stress values significantly different? Please provide an explanation for your response.

3. Were the average breaking stress values for Sample 4's trials 1 – 10 and trials 11 – 20 different? Please provide a reason for the different average values (if they existed).

4. Based on the *t*-test results for Sample 4's trials 1 – 10 and trials 11 – 20, were the average breaking stress values significantly different? Please provide an explanation for your response.

5. Were the average breaking stress values for Sample 1's trials 1 – 12 and Sample 4's trials 1 – 20 different? Please provide a reason for the different average values (if they existed).

6. Based on the *t*-test results for Sample 1's trials 1 – 20 and Sample 4's trials 1 – 20, were the average breaking stress values significantly different? Please provide an explanation for your response.