Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

****

**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.