Challenger Space Shuttle Activity

Worksheet

TASK I

Graph the space shuttle o-ring data.

TASK II

Write a paragraph documenting whether you think the Space Shuttle should have been launched on its final day and explain why.

Challenger Space Shuttle

Launch Temperature vs. Success Data Sheet

|  |  |  |
| --- | --- | --- |
| **Date** | **Temperature** | **# Damaged O-rings** |
| 4/21/81 | 66 | 0 |
| 11/12/81 | 70 | 1 |
| 3/22/82 | 69 | 0 |
| 6/27/82 | 80 | Data not available |
| 11/11/82 | 68 | 0 |
| 4/4/83 | 67 | 0 |
| 6/18/83 | 72 | 0 |
| 8/30/83 | 73 | 0 |
| 11/2/83 | 70 | 0 |
| 2/3/84 | 57 | 1 |
| 4/6/84 | 63 | 1 |
| 8/30/84 | 87 | 1 |
| 10/5/84 | 78 | 0 |
| 11/8/84 | 67 | 0 |
| 1/24/85 | 53 | 3 |
| 4/12/85 | 67 | 0 |
| 4/29/85 | 75 | 0 |
| 6/17/85 | 70 | 0 |
| 7/29/85 | 81 | 0 |
| 8/27/85 | 76 | 0 |
| 10/3/85 | 79 | 0 |
| 10/30/85 | 75 | 2 |
| 11/26/85 | 76 | 0 |
| 1/12/86 | 58 | 1 |
| 1/28/86 | 31 | Challenger Accident |

Challenger Space Shuttle Story

On January 28, 1986, the Challenger space shuttle was launched from the Kennedy Space Center in Florida. Shortly into the flight it exploded, killing all seven crew members. After the accident, President Reagan appointed a commission headed by former Secretary of State William Rogers to find the cause. The Rogers Commission report included the following information:

The night before the launch there was a three-hour teleconference among people from the Kennedy Space Center, NASA (National Aeronautics and Space Administration), and the company that manufactured the solid rocket motors. The discussion focused on the predicted 31 degree Fahrenheit temperature at launch time and the possible effect of such a low temperature on O-ring performance. The O-rings seal the joints between different sections of the solid rocket motors. In essence, each O-ring is a large rubber washer about 35 feet in diameter and ¼ inch thick. After a shuttle is successfully launched, the rocket motors are jettisoned into the ocean and recovered. The O-rings can then be examined for possible damage that occurred during the launch. Thus, data were available from 23 previous space shuttle launches giving the temperature at launch time and the number of incidents of O-ring damage in that launch.

During the teleconference the night before the Challenger launch, a data set and associated scatter plot played an important role in the discussion. Each plotted point represents one of the seven shuttle flights that experienced some O-ring damage; the horizontal axis shows the temperature at launch and the vertical axis shows the number of O-rings that sustained damage in these flights.

*The teleconference participants debated whether these historical data implied a temperature effect on O-ring performance. Some participants recommended that the launch be postponed until the temperature rose above 53 degrees Fahrenheit – the lowest previous launch temperature – because that flight had the largest number of damaged O-rings. Some participants also stated that separate physical evidence suggested a temperature effect on O-ring performance. On the other hand, the history showed that the second largest number of damaged O-rings occurred at the highest temperature. Ultimately, based on the* U *configuration of points in the scatter plot, it was concluded that there was no evidence from the historical data about a temperature effect. The official recommendation from the rocket manufacturer to NASA stated that the temperature data were not conclusive in predicting O-ring damage.*

The Rogers Commission concluded that the cause of the accident was the complete failure of an O-ring on a rocket motor, which lead to the explosion. This is the type of failure that was debated the night before in the teleconference, where the participants tried to decide whether the chance of extensive O-ring damage might be substantially increased by low temperature. The temperature at launch was 31 degrees Fahrenheit. The Rogers Commission also noted that a mistake had been made in the analysis of the historical data.