The space shuttle *Challenger* was in launch position the morning of January 28, 1986, with seven astronauts and passengers on board. Just prior to the launch, sheets of ice clung to the fuselage. Moments later, with national television coverage as it blasted into orbit, the shuttle disintegrated in a catastrophic explosion. The remains of the astronauts and passengers were never recovered.

Thiokol Corporation manufactures the two solid-fuel rocket motors that propelled the shuttle into space. The night before the catastrophe, executives of Thiokol and NASA debated whether they should launch the shuttle according to schedule or postpone the mission. The weather report called for a temperature of 31 F at blast off. At the conclusion of the debate, Thiokol executives recommended that the shuttle be launched on schedule because they felt that they did not have conclusive evidence that the low temperature would influence the capability of the solid-fuel rocket motors.

From April 12, 1981 to January 12, 1986, the space shuttle had flown 24 successful missions. Six primary O-rings were used to seal the sections of the two solid-fuel rocket motors. On several flights, the motors had experienced O-ring erosion or gas blow-by incidents. O-ring incidents are extremely dangerous because a failed O-ring can allow super-hot gases to escape the motors and ignite the liquid hydrogen fuel tank. On one of the 24 flights, the motors were not recovered. The number of erosion or blow-by incidents and the temperature at launch for 23 successful flights are given in the following table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mission | O-Ring Incidents | Temperature | Mission | O-Ring Incidents | Temperature |
| 1 | 0 | 66 | 13 | 0 | 67 |
| 2 | 1 | 70 | 14 | 2 | 53 |
| 3 | 0 | 69 | 15 | 0 | 67 |
| 4 | 0 | 68 | 16 | 0 | 75 |
| 5 | 0 | 67 | 17 | 0 | 70 |
| 6 | 0 | 72 | 18 | 0 | 81 |
| 7 | 0 | 73 | 19 | 0 | 76 |
| 8 | 0 | 70 | 20 | 0 | 79 |
| 9 | 1 | 57 | 21 | 2 | 75 |
| 10 | 1 | 63 | 22 | 0 | 76 |
| 11 | 1 | 70 | 23 | 1 | 58 |
| 12 | 0 | 78 |  |  |  |

1. Create a scatterplot of the data and include the regression equation. The number of O-ring failures is the dependent variable, Y, and the independent variable is temperature, X.
2. Is there a significant relationship between number of failures and temperature? Please explain how you have made this decision. You may use *α* = *.*05.
3. It is important to determine whether colder temperatures have a higher number of O-ring failures. Suppose you are trying to convince Thiokol and NASA that low temperature at launch time is a danger. Set up and perform an appropriate hypothesis test. Make sure you state the null and alternative, the p-value, and your conclusions. You may use *α* = *.*05
4. Predict the number of 0-ring failures for a launch at 31 F, the temperature when Challenger was launched. Does it look as if there was a serious problem? Please explain.