

**“The effect of the average annual high temperature on the amount of rainfall in New York City”**

This project was evaluated using the point scale of 0-1-2-3. The project was evaluated based on the visible information in the project photograph; some more information may have been on the additional sheets.

**A. Title**

**Title:** The effect of the average annual high temperature on the amount of rainfall in New York City.

**Score: 3** – *The title correctly states the independent variable and the dependent variable and is NOT worded as a question.*

**Comments:** The large title on the top of the project is worded as a question, however the student did have a correct title in the “Investigation Design Diagram” section. Urban Advantage recommends the title of the project, as displayed largely at the top, is not worded as a question.

**B. Question**

**Question:** How does the average annual high temperature affect the amount of annual rainfall in New York City?

**Score: 3** – *The question states the independent variable and the dependent variable, and is testable.*

**Comments:** This question correctly states the independent and dependent variable. In addition, the dependent variable is testable.

**C. Hypothesis**

**Hypothesis:** If the annual high temperature were to increase, then the annual amount of rainfall will be greater because warmer air can hold more water vapor.

**Score: 3** – *The hypothesis (1) predicts the effect that changing the independent variable will have on the dependent variable, AND (2) explains the reason for the prediction using scientific concepts (“because...”).*

**Comments:** The student states that in years with higher temperature (independent variable) there will be more total precipitation (dependent variable) because “warmer air can hold more water vapor”. Their background research goes into detail about some of the reasons why there is more water vapor in warmer air.

**D. Background Research (found throughout the project especially within the hypothesis and discussion/conclusion sections)**

**Score: 2** – *Background research is accurate, containing SOME relevant, well-chosen facts, definitions, concrete details, quotations, scientific concepts, or other information and examples that (1) provide information on the IV & DV AND (2) attempts to support the “because” portion of the hypothesis OR (3) attempts to support the “scientific reasoning” of the discussion/conclusion.*

**Comments:** The student provides information on the relationship between temperature and water vapor, but more detailed information on the whole process of precipitation and the water cycle would be more informative to both their hypothesis and their conclusion/discussion. There are some misconceptions (or inaccurate sources of information). Clouds are not water vapor, but condensed water (related to water vapor) and the amount of water vapor in the air depends on the temperature but not actually the “space” between air molecules (oxygen and nitrogen). The process of air masses cooling relates to cloud formation, and is essential to a description of the relationship between temperature changes and precipitation. The hypothesis/research section states that “due to climate change, more rainfall will occur” but doesn’t provide more detail on the mechanism.

### **E. Investigation Design (ID)**

**Score: 3** – All 5 components of the investigation’s design (or ID) are stated correctly and explicitly, AND only one independent variable (or IV) is allowed to change at a time, AND there are multiple trials.

**Comments:** The ID correctly states the independent variable (average annual high temperature), dependent variable (average annual rainfall in New York City), sources of data, number of data points, and time span over which the data was collected.

### **F. Procedure**

**Score: 2** – The Procedure accurately and completely satisfies two or three of the above. (The procedure is (1) a step-by-step description of how the investigation was done AND (2) uses precise language and scientific vocabulary to describe both the sequence of actions taken and materials used AND (3) is sufficiently detailed to enable the reader to replicate the investigation AND (4) is consistent with the Investigation Design Diagram (IDD) and is an appropriate test of the hypothesis.)

**Comments:** The procedure is a step-by-step set of instructions on how the investigation was performed. In secondary research, other scientists’ data is used BUT detail should be included on how those scientists collected the data. Specifically for this project on weather, it should mention where the data was collected, how it was collected (high and low temperature, etc.), and the source of the data (NOAA, NCDC, Weather Underground, etc.). That would be an additional opportunity to use precise scientific vocabulary and precise language. The details are not thoroughly sufficient for the reader to replicate the investigation.

### **G. Data/Results**

**Score: 3** – Data table(s) and graph(s) (1) are accurate and include labels (titles, axes with units of measure AND (2) address the hypothesis and have been chosen to clearly address the original question AND (3) data analysis identifies and accurately summarizes trends and patterns in the data.

**Comments:** Graphs include correct labels and address the original question. The first graph and second graph display the same information, one with a trendline. These two can be combined to use the space on the project board for other analyses, larger graphs, or more text. The axes labels would be easier to read in a larger font size BUT do not have the correct information. The data analysis is summarized in a “Data Analysis” section and does not connect back to the investigation question. The discussion of “Z-scores” isn’t entirely accurate or relevant, but also doesn’t change the outcome of the investigation. It is also worth mentioning that both precipitation and temperature seem to be significantly increasing over time but overall hotter years so not seem to have more precipitation.

### **Ha. Discussion/Conclusion: Scientific Explanation**

**Score: 2** - Three or four parts of the Scientific Explanation are complete and accurate. A scientific explanation consists of a statement that makes an overall claim addressing the original investigation question AND supports the claim with evidence and relevant, accurate data from the investigation AND contains relevant scientific concepts AND uses words, phrases and clauses that clarify and connect the relationships between claim, evidence and science concepts AND demonstrates an understanding of the topic.

**Comments:** The student makes an overall claim addressing the original investigation question and supports this claim with evidence, “was almost no correlation between the temperature and precipitation.” The conclusion contains relevant scientific concepts but could go into some more detail to better demonstrate that the student has an understanding of the topic.

### **Hb. Discussion/Conclusion: Reflection**

**Score: 2** – Two or three parts of the Reflections are complete and accurate.

**Comments:** The student clearly states the hypothesis was not supported and mentions a “Next Steps” determined as a result of this investigation. To improve the reflection the student could include a description of possible sources of error and suggested solution to these sources of error. The hypothesis was not supported by the data and an alternative explanation for the observations

should be offered. Was this result due to error or is there another scientific reason why these two variables are not correlated? Other next steps might be to analyze monthly or even daily data OR to look for other ways of connecting increased temperature to subsequent higher precipitation.

### I. Literature Cited

**Score: 1** – *Few parts of the Literature Cited are complete and accurate.*

**Comments:** The project could be improved by more credible sources that include books, articles, scholarly websites, or personal communication with knowledgeable experts/scientists. The resources cited are online news articles. A source like Wikipedia (that also lists its sources) would have provided a lot of information on the science concepts needed for this investigation. All sources should be cited in the test of the hypothesis, background research, conclusion, and other sections as appropriate.

<b>Project Section</b>	<b>Score (0-3)</b>	<b>Weight</b>	<b>Weighted Score</b>
A. Title	3	x 1	= 3
B. Question	3	x 1	= 3
C. Hypothesis	3	x 2	= 6
D. Background Research	2	x 2	= 4
E. Investigation Design (ID)	3	x 2	= 6
F. Procedure	2	x 2	= 4
G. Data/Results	3	x 3	= 9
Ha. Discussion/Conclusion: Scientific Explanation	2	x 2	= 4
Hb. Discussion/Conclusion: Reflections	2	x 1	= 2
I. Literature Cited	1	x 2	= 2
		<b>Total weighted score</b>	<b>= 43 (54 max)</b>
	<b>Final Score (%) =</b>	<b>=Total weighted score/54 x 100</b>	<b>= 80%</b>