Testing Hypotheses

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Printed: July 25, 2012

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CONCEPT 1

Testing Hypotheses

- Identify and explain the steps required to test a hypothesis.

How can I show that my hypothesis is wrong?

Many young scientists learn that a good scientist tries to disprove her hypothesis. This is the best way to be sure that your hypothesis is getting a rigorous test. Why do you think established scientists tell students this? Why is it a good idea?

Testing Hypothesis 1

How do you test a hypothesis? In this example, we will look into the scientific literature to find data in studies that were done using scientific method.

To test Hypothesis 1 from the concept "Development of Hypotheses," we need to see if the amount of CO_2 gas released by volcanoes over the past several decades has increased.

There are two ways volcanoes could account for the increase in CO_2:

- There has been an increase in volcanic eruptions in that time.
- The CO_2 content of volcanic gases has increased over time globally.

To test the first, we look to the scientific literature and find this graph:

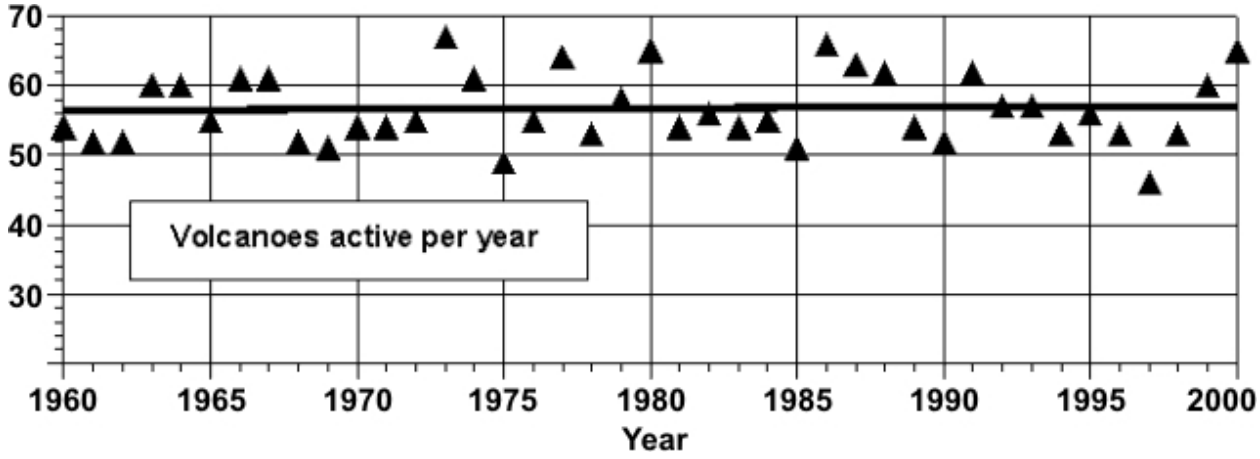

FIGURE 1.1

Number of active volcanoes since 1960.

We see that the number of volcanic eruptions is about constant. We also learn from the scientific literature that volcanic gas compositions have not changed over time. Different types of volcanoes have different gas compositions, but overall the gases are the same. Another journal article states that major volcanic eruptions for the past 30 years have caused short-term cooling, not warming!

Hypothesis 1 is wrong! Volcanic activity is not able to account for the rise in atmospheric CO_2. Remember that science is falsifiable. We can discard Hypothesis 1.

Testing Hypothesis 2

Hypothesis 2 states that the increase in atmospheric CO_2 is due to the increase in the amount of fossil fuels that are being burned. We look into the scientific literature and find this graph.

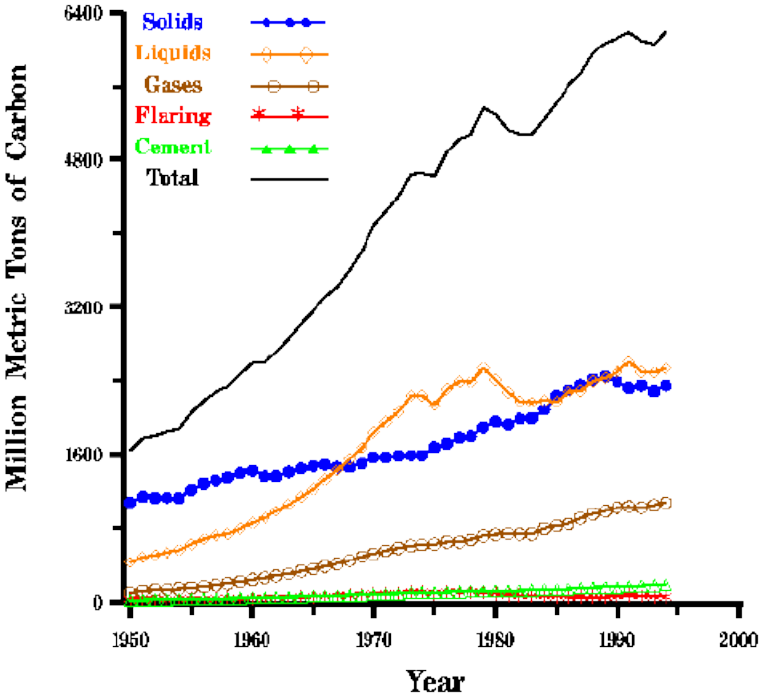

FIGURE 1.2

Global carbon dioxide emissions from fossil fuel consumption and cement production. The black line represents all emission types combined, and colored lines show emissions from individual fossil fuels.

Fossil fuels have added an increasing amount of carbon dioxide to the atmosphere since the beginning of the Industrial Revolution in the mid 19th century. Hypothesis 2 is true!

Summary

- Science is falsifiable. An incorrect hypothesis is discarded.
- Carbon dioxide levels in the atmosphere are increasing due to fossil fuel burning.

Practice

Use this resource to answer the questions that follow.

http://www.youtube.com/watch?v=LjbJELjLgZg

Note: the term theory is used inaccurately in the video.

MEDIA

Click image to the left for more content.

1. How are they using the word theory in this video? What word would be more accurate for them to use in this context?

2. What is the hypothesis they are testing?

3. How do they test the hypothesis?

4. What were their results?

5. Is their hypothesis absolutely certainly correct? If you say, that they don't know yet, what can they do to further narrow down whether the hypothesis is correct?

Review

1. Think of at least one other hypothesis for why atmospheric carbon dioxide has been rising for the past several decades. How would you test that hypothesis?
2. If your hypothesis is shown to be true, does that mean that hypothesis 2, which states that the increase in atmospheric CO_2 is due to fossil fuel burning, is wrong?
3. How did having multiple working hypotheses help this investigation along?