Name Answer Key Date

PROBLEM SOLVING

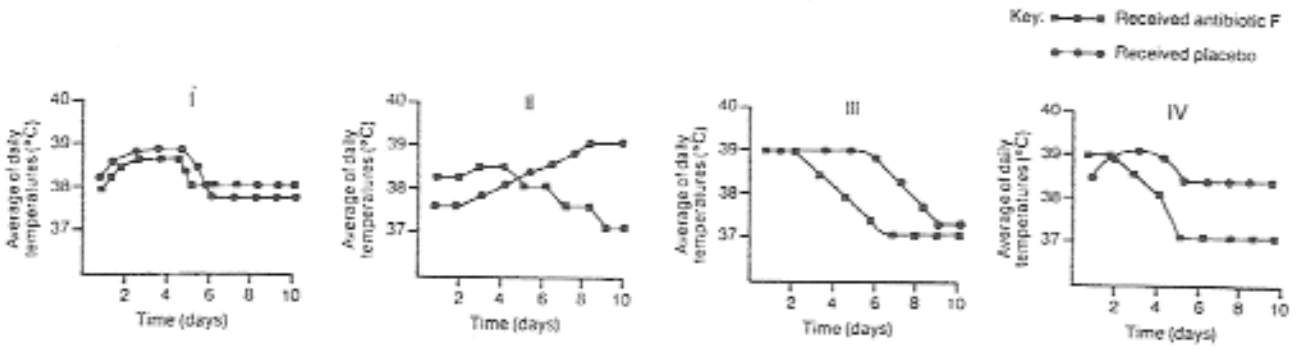
Analyzing Data

A scientist wished to determine if a new type of antibiotic, called antibiotic F, was effective against a particular type of microorganism that caused pneumonia. To test the hypothesis, the scientist asked for 100 volunteers in a large hospital. All the volunteers were suffering from the same type of pneumonia. The scientist gave 50 of the volunteers the new antibiotic 3 times a day for 10 days. The other 50 volunteers were given a sugar pill 3 times a day for 10 days. The sugar pill is called a placebo.

The scientist measured the effectiveness of the antibiotic against the disease-causing microorganism by measuring each volunteer's temperature. Higher than normal body temperature indicated the presence of the disease-causing microorganisms. When a volunteer's temperature remained normal (37°C) for three days, he or she was considered free of the disease-causing microorganism.

At the end of the experiment, the scientist analyzed the data and concluded that antibiotic F was not effective against the microorganism that caused this type of pneumonia.

1. What was the scientist's hypothesis? Antibiotic F is effective against a particular type of microorganism that caused pneumonia
2. Identify the control group. 50 volunteers given sugar pill
3. Identify the experimental group. 50 volunteers given new antibiotic



4. Which graph indicates that the antibiotic was not effective against the disease-causing microorganism? Explain your answer. I - both groups show the same result
5. Which graph supports the scientist's original hypothesis? Explain your answer. III - the antibiotic group had drop in temp much quicker
6. Can you think of any other observations the scientist might have made in this experiment? Blood test to see if microorganism present after Inoculation
7. Why do you think the scientist gave 50 of the volunteers a placebo? No one knew if they were part of experimental group or control group. This is called a blind study.

OUTBREAKOFMEASLES: An investigation using the scientific method

Read the six steps below.

1. An outbreak of measles occurred among men in an army recruiting center.
2. The doctors gave innoculations of gamma globulin to a group of 67 men. Gamma globulin is the antibody for measles.
3. They observed another group of 37 men who were not inoculated.
4. Within 14 days, one man of the first group and 18 of the second group developed an average case of measles.
5. They decided that too few men had been used to justify positive conclusions.
6. They later repeated the experiment with two more groups of men.

Next to each letter write the number or numbers from above that apply to the steps of the scientific method listed below.

1 A. Defining the problem

2,3 B. Designing the experiment

6 C. Verifying the results of the experiment.

3 D. Introducing a control.

5 E. Analyzing the experiment

Answer each of the questions that follow.

1. What was the variable in the experiment? innoculations
2. What was the control in the experiment? group who were not innoculated
3. Circle the letter of the conclusion which is justified by the results of the experiment.

   A. The two groups were not equal in numbers. No conclusion should ever be made unless the groups are equal in size.
   B. Gamma globulin is a cure for measles.
   C. Gamma globulin is a certain preventive for measles.
   D. Gamma globulin has value as a preventive for measles.
   E. Gamma globulin has value as a cure for measles.
   F. The men of the second group had already had measles before being inoculated, while those of the first group had not.

Anthrax is a severe, contagious disease of animals and people. Animals with anthrax usually die suddenly. Robert Koch discovered a bacterium responsible for anthrax. When outside a living body, anthrax bacteria form spores, reproductive cells that can exist for long periods of time with no food or water. Spores can be killed only by burning. If any animal with anthrax did not die, it never caught anthrax again. If a mild form of anthrax had existed, it could have been deliberately given to an animal as a vaccine to make the animal immune. But a mild form of anthrax did not exist.

Louis Pasteur had an idea for immunizing animals from anthrax. He collected some anthrax bacteria from infected animals. He then heated the bacteria to weaken, but not kill them. In 1881, Pasteur inoculated half of a herd of sheep with the anthrax bacteria he had weakened. After a period of time, he inoculated the whole herd with full-strength anthrax bacteria. The animals that had not previously received the weakened form of anthrax became ill and died. Those that had previously received the weakened anthrax bacteria remained healthy.

1. What is the testable question? Will an inoculation of weakened anthrax bacteria keep an animal healthy?
2. What is the independent variable? inoculation
3. What is the dependent variable? animals becoming ill (& dying)
4. What are the conclusions and interpretation of the results?
The weakened bacteria did protect the animals. The animals that got the inoculation remained healthy.

The Goniff Pharmaceutical Company says that Noalgia, a new drug recently marketed by Goniff, is a superior form of medication for headaches. Goniff bases this claim on their own studies. The FDA endorsed a new study of Noalgia. A group of 100 people with severe supraorbital headaches were tested. With the onset of headache each subject took 2 tablets of Noalgia. After 2 hours the subjects reported as follows:

40 subjects – headache gone
50 subjects – headache greatly diminished
10 subjects – no change in severity of headache

1. What is the hypothesis? Noalgia will cause headaches to diminish or disappear
2. What are the controls or the control group? Each subject took 2 tablets
3. What is the dependent variable? status of headache
4. If you were doing this study, could you do anything to improve the study?
Have a control group where 100 people get a headache but take a placebo (or fake tablet)

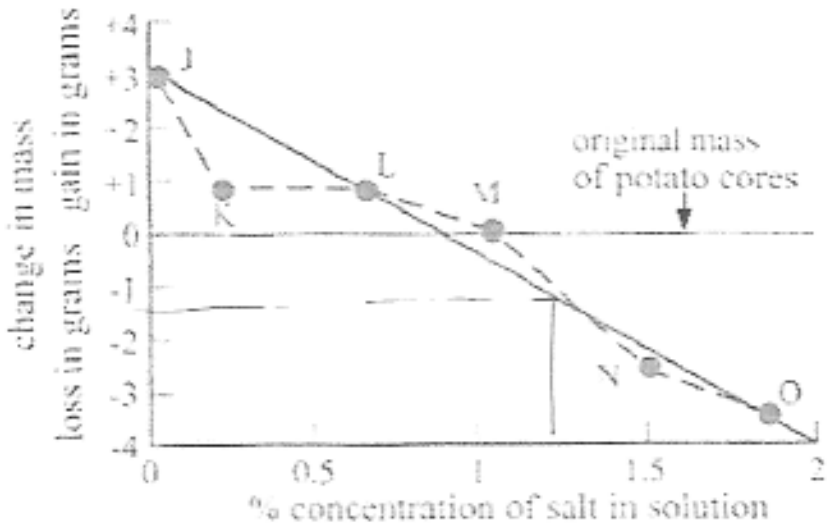
Remember a testable question has the following characteristics:

It is measurable
It looks for relationships ←
It isolates variables
It can be tested by experiment or measurement
It builds on what you know
It leads to other questions
It can have an answer

Identify each question as testable or not testable

•How does a mealworm stay upside down with only 6 legs? Not testable
•Does the texture of the medium that the mealworm is placed on affect the way it moves? Testable
•How do the mealworms react to light? Not testable
•In a confined area, with a light shining on it, will the mealworm try to go to the shade? Testable

An experiment was designed to study the effects of salt concentration on the mass of potato tissue. Six pieces of potato of equal mass were placed in six different concentrations of salt water for the same amount of time. The mass was measured, and changes (if the potato gained or lost water) were recorded on the graph.



1. The graph shows that potato tissue gets heavier.
   a. As the salt concentration increases
   b. As the salt concentration decreases
   c. The longer it is left in salt solution
   d. Because it loses water to the salt solution

2. In the graph above, the dots J, K, L, M, N and O represent
   a. Conclusions
   b. Qualitative observations
   c. Hypotheses
   d. Data

3. Which line represents the best fit line, the dashed or the solid line? solid
4. What would you expect to happen to the potato if it was placed in a 1.25% salt solution?
   It would lose about 1.5 grams

A scientist observed that tobacco plants flower only at certain times of the year. After careful consideration of the phenomenon, the scientist conducted an experiment. She grew five tobacco plants and exposed each to a specific amount of daily light. All of the plants had leaves of the same height. Differences appeared in the flowers that appeared. The results are listed below.

At 10 hours of daylight a flower had grown to a height of 1 foot but the flower was not opened.
At 12 hours of daylight a flower had grown to a height of 1 foot and it was partially opened.
At 14 hours of daylight a flower had grown to a height of 1 foot and it was fully opened.
At 16 hours of daylight a bud for a flower stalk had started to grow but was only 5 inches long.
At 18 hours of daylight a bud for a flower stalk had started to grow but was only 5 inches long.

What are the conclusions and interpretation of the results?

14 hours has the only fully opened flower
It appears that the best amount of daylight
is around 14 hours. Too little or too much
results in flower that don't open or grow very slowly.