

# Guide to Science Experiments

## Planning and Conducting Experiments

### Vocabulary Words to Know

**SCIENTIFIC:** having to do with science and its rules. The orderly process for conducting experiments is called the *scientific method*.

**COLLECT:** in an experiment, to watch, write down, or log all of the results of your tests.

**ANALYZE:** to look at information carefully, looking for patterns or solutions.

**INTERPRET:** to use your skills and knowledge to look at information and make a statement about what the information means for you.

**DATA:** the numbers and information you *collect* when doing your experiment.

**OBSERVATION:** looking and recording what you see.

**DESIGN:** to make up and plan an experiment, how it will go, and what it will prove.

**CONDUCT:** to perform an experiment.

**INVESTIGATION:** the time when you look at and study a problem.

**COMMUNICATE:** to tell others about our experiment by talking and writing up the experiment for others to read.

**TESTABLE:** an idea that you should be able to prove by investigating.

**HYPOTHESIS:** what you think is the answer to the problem.

**CONTROLS:** things you leave the same when you do an experiment.

**VARIABLES:** things you affect in an experiment to see if it makes a difference.

**PREDICTIONS:** things you guess will happen in an experiment.

**RE-EVALUATION:** looking at the experiment again to see if you have the right answer and if you did everything correctly.

**ERROR ANALYSIS:** looking at mistakes to try to determine why they happened.

## Step-by-Step

**You are about to do an experiment along with the students described. Compare each step in the process with the vocabulary words to see how we use the *scientific method* to perform an experiment in a real-life situation! You will go through each step and arrive at a conclusion, and then make a written presentation.**

### **The problem:**

This is where we always start. Maybe it is not a big problem, but it is something we want to know and understand.

In this case, Ralph is missing too many shots during basketball games. **(Problem)**

His coach says he holds his hands incorrectly. **(Hypothesis)**

Javon holds his hands the way Coach wants him to. **(What is tested; in this case, we want to see if Javon's hand position is what makes him a better shot than Ralph)**

Javon challenges Ralph to a contest. They will shoot 20 shots. **(Experimental design)**

Javon will hold his hands the same way for all 20 shots. **(Control)**

Ralph will change the way he holds his hands after 10 shots. **(Variable)**

He will shot the last 10 shots with his hands held the same way Javon holds his. **(What is tested)**

Coach will write down the shots by making a tally for each basket they shoot. **(Data collection)**

They have the contest. **(Conducting the experiment)**

Javon makes 18 shots out of his total 20, holding his hands the same way each time.

Ralph makes 7 of 10 shots with his hands his usual way, and he makes 10 of 10 shots with his hands held Javon's way. **(Data and results)**

| <b>JAVON'S SHOTS</b>    | <b>RALPH'S SHOTS</b>    |
|-------------------------|-------------------------|
| 1 <sup>ST</sup> 10: 8   | 1 <sup>ST</sup> 10: 7   |
| 2 <sup>ND</sup> 10 : 10 | 2 <sup>ND</sup> 10 : 10 |
| <b>total: 18</b>        | <b>total: 17</b>        |

Coach and Javon and Ralph sit down and go over the data. **(Discussion)**

They try to decide if changing hand positions mattered. **(Analyze and interpret data)**

Javon thinks maybe Ralph should have tried more shots. **(Re-evaluation)**

They talk about mistakes or how they would do the experiment differently if they did it again. Coach says maybe they ought to look at the shots Ralph missed to see if it was more than how he placed his hands. **(Error analysis)**

Fill in the lab sheet below with the information for Ralph's basketball experiment.

|                                                             |
|-------------------------------------------------------------|
| <b>Problem:</b> <i>Ralph is missing too many free shots</i> |
| <b>Hypothesis:</b>                                          |
| <b>What is tested:</b>                                      |
| <b>Experimental design:</b>                                 |
| <b>Control:</b>                                             |
| <b>Variable:</b>                                            |
| <b>How is data collected:</b>                               |
| <b>Data and results:</b>                                    |
| <b>Analyze and interpret data:</b>                          |
| <b>Discussion:</b>                                          |
| <b>Re-evaluation:</b>                                       |
| <b>Error Analysis:</b>                                      |

Can you name any other re-evaluation or error analysis items?

What do you think the basketball experiment proved or did not prove?

## Class Party!

**Try another experiment. This time you will have to name the elements of the experiment yourself.**

Nat and Alonzo need to buy refreshments for the class party. Alonzo says that at previous parties, people did not like the food. Nat's favorite foods are hot dogs with salsa, and blueberry muffins, with orange soda-pop for a drink. Alonzo says they need to find out what the other students would like to eat. Nat says he thinks everybody will like the same foods as he does. They decide to take a survey of the class and record their data to decide what they want to eat.

They make up a ballot that looks like this:

**Meal 1:** Hot dogs with salsa, blueberry muffins, and orange soda-pop

**Meal 2:** Nachos with popsicles and lemonade

**Meal 3:** Chili dogs, chips and soda

**Meal 4:** Pizza with chips and juice

**Meal 5:** Hamburgers with fries and a soda

They pass the ballot out to the class and each student picks one meal as his favorite.

Nat and Alonzo *tally*, or *add up*, the ballots using tally marks and a sheet like this.

|                |                 |
|----------------|-----------------|
| Meal 1:        | 2               |
| Meal 2:        | 16              |
| Meal 3:        | 5               |
| Meal 4:        | 8               |
| Meal 5:        | 9               |
| <b>Total:</b>  | <b>30 votes</b> |
| <b>Winner:</b> | <b>Meal 2</b>   |

Nat and Alonzo sit down and look over the results. Most of the class wants nachos with popsicles and lemonade. Nat is surprised.

Alonzo thinks maybe they had too many choices on the ballots and people may not still be satisfied. Nat also realizes they did not ask what flavor of popsicles people want.

**Fill in the chart for Nat and Alonzo's experiment.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

### A Doggone Experiment!

Nancy’s dog, Spike, is not eating his dog food. Her mother says he is just tired of the brand they use. Her mom suggests that she do an experiment where they offer Spike different kinds of food and keep track of which ones he eats. She bought small bags of his regular food, Yummie Food, Canine Cuisine, Pop Dogs, and Top Doggie. Each day she puts out a bowl with a different kind and writes on a chart whether he ate it or not.

At the end of five days, the chart looked like this:

|                |              |             |
|----------------|--------------|-------------|
| Regular        | yes          | <b>no X</b> |
| Yummie food    | yes          | <b>no X</b> |
| Canine Cuisine | <b>yes X</b> | no          |
| Pop Dogs       | <b>yes X</b> | no          |
| Top Doggie     | yes          | <b>no X</b> |

Nancy says that all this proves is that Spike does not like his other food and would rather eat Pop Dog or Canine Cuisine. Nancy’s mother says it proves he does not like his regular food and might eat several other kinds of food. Nancy’s mother says they need to do the experiment again and have him chose between Pop Dog and Canine Cuisine only.

**Fill in the chart for Spike's food experiment.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

### The Stain Game

Melody has a big ketchup stain on her new cotton jacket. It is washable, but Melody's mother tells her to treat the stain with something before she put it in the washing machine, to make sure the stain comes out.

Mrs. X says to use hairspray on the stain.

Ms. K. says to use shampoo on the stain.

Grandma says to use salt.

Melody decides to cut out 4 pieces of cotton cloth and make a ketchup stain on each one. She treats Cloth 1 with nothing, Cloth 2 with hairspray, Cloth 3 with shampoo, and Cloth 4 with salt.

She sets them aside for 6 minutes, then rinses them out and puts her results on a chart.

|            |                            |
|------------|----------------------------|
| Nothing    | stain out? <b>No</b>       |
| Hair Spray | stain out? <b>A little</b> |
| Shampoo    | stain out? <b>All out</b>  |
| Salt       | stain out? <b>No</b>       |

Melody decides that shampoo works the best on ketchup stains.

Melody's mother says that maybe they should have tried using a little bit of the detergent. Melody wonders if other kinds of shampoo would work just as well.

**Fill in the chart for Melody's experiment.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

### Word Games

Jon is not learning the vocabulary words for tests and makes bad grades because of this. He asks his friends for advice.

Matthew says he learns things better if he hears them repeated many times. Marvin says he learns better if he writes the information 10 times. Al says he looks at it for 10 minutes and learns it. Jon says he does not have a way to learn. The boys decide to have an experiment. They will pick 30 words and their definitions and each boy will teach them to Jon in his style of learning. Matthew will have Jon tape record and listen to his words and their definitions for 10 minutes a day for 3 days in a row. Al will make a copy of all of the words and their definitions and have Jon stare at it for 10 minutes a day for 3 days in a row. Marvin will help Jon copy the words and their definitions over and over for 10 minutes a day for 3 days in a row.

On day 4, Jon took four vocabulary tests. The boys will looked at his answers and tallied up which words were learned with each way of teaching and which ones he got correct. They compared the results to decide which study method was the best for Jon.

The results were put in this chart.

Jon’s normal method of studying gave him a test score that was 5/10 correct, or 50%.

| <b>Al’s method</b> | <b>Marvin’s method</b> | <b>Matthew’s method</b> |
|--------------------|------------------------|-------------------------|
| 9/10               | 2/10                   | 5/10                    |
| 90%                | 20%                    | 50%                     |
| FIRST              | THIRD                  | SECOND                  |
| LISTENING          | LOOKING                | WRITING                 |

The boys decided that Jon did better learning words by listening to them over and over.

Looking was the least helpful way. Writing only worked half, or 50%, of the time.

Marvin says he felt Jon did not pay enough attention, and Matthew says he could improve using writing if he practiced more.

Matthew thinks that Jon should try his way more often. Jon thinks maybe he could listen to the words and write them at the same time and make his grade go up even more. He thought Marvin’s way would help with spelling words and learning math formulas.

Jon is happy that he passed the test, but hopes to get better than 70%--a grade of C.

**Fill in this chart with information from the boys' experiment.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

## Puppy Trouble

Sisters Halley and Ginger are both training their puppies, Romper and Bumper, to come to them when they call. Both dogs run away and go the wrong way, or just sit and look at them. The girls' parents say the dogs have to be well-trained.

Ginger's father says to put the puppies on leashes and call them. If they do not come, he says to jerk the leashes and pull them over. Halley's grandmother says to call them, and when they come, give them a treat. Ginger's grandfather made up this experiment. The girls tried their father's way in the morning, and their grandmother's way at night, for one week. At the end of the week, they had a contest to see which way worked best in six tries. They had their grandfather conduct the experiment and record the data on this chart that he made.

| Father's way                           | Grandmother's way                      |
|----------------------------------------|----------------------------------------|
| Romper no    Bumper no                 | Romper yes    Bumper yes               |
| Romper no    Bumper no                 | Romper yes    Bumper yes               |
| Romper no    Bumper no                 | Romper yes    Bumper yes               |
| Romper no    Bumper no                 | Romper yes    Bumper yes               |
| Romper no    Bumper no                 | Romper yes    Bumper yes               |
| Romper no    Bumper yes                | Romper yes    Bumper yes               |
| <b>Romper 0/6</b><br><b>Bumper 1/6</b> | <b>Romper 6/6</b><br><b>Bumper 6/6</b> |

Their grandfather totaled up his data, and he said that it looked like the dog preferred getting treats a lot more than getting jerked and pulled. Their father says that the dogs will get too fat using their grandmother's way. Their grandmother says it is mean to jerk them around on the leash.

Their grandfather thought that maybe the second dog to be called was just copying the first, so if they did it again, he would test the dogs one at a time. The girls think the dogs are better trained and want to use treats for training everything they want the dogs to do.

**Fill in this chart on the puppy experiment.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

### Doing it Yourself – The Track Meet

**You will be given the problem and asked to imagine and write up your experiment.**

None of the track team members are increasing their speed in their races. Coach wants them to improve their speed so that they can win the next track *meet*, or *contest*. Malik runs three miles daily and says it helps him. Mr. K, a teacher, says they should do speed drills—short races to increase speed. Ms. P, the girls’ volleyball coach, thinks the team should not run more, but should lift weights instead.

**Design and imagine your experiment and record data. Write it up on this chart.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

**Do It Yourself –Ear Test**

Ty has a bad earache. His mother wants to take him to the doctor, but his grandmother and the lady next door have other ideas for herbal remedies that work really fast on earaches. Grandma says to put cotton balls soaked in olive oil in his ears, while the lady next door says to drink mint tea three times a day. Ty hates to go to the doctor. His mother says she will take him in 4 days if he is not better.

**Design and imagine an experiment for Ty’s earache, and fill in this chart.**

|                                    |
|------------------------------------|
| <b>Problem:</b>                    |
| <b>Hypothesis:</b>                 |
| <b>What is tested:</b>             |
| <b>Experimental design:</b>        |
| <b>Control:</b>                    |
| <b>Variable:</b>                   |
| <b>How is data collected:</b>      |
| <b>Data and results:</b>           |
| <b>Analyze and interpret data:</b> |
| <b>Discussion:</b>                 |
| <b>Re-evaluation:</b>              |
| <b>Error Analysis:</b>             |

**Can you name any other re-evaluation or error analysis items?**

**What do you think the basketball experiment proved or did not prove?**

### Fun with Vocabulary Words

|               |                |          |            |
|---------------|----------------|----------|------------|
| controls      | error analysis | conduct  | interpret  |
| variable      | hypothesis     | design   | analyze    |
| predictions   | observation    | testable | collect    |
| re-evaluation | communicate    | data     | scientific |

Using the words from the text box, unscramble the letters below.

1. EELCOCT \_\_\_\_\_
2. BELIVARA \_\_\_\_\_
3. FICCSNIETIC \_\_\_\_\_
4. STROLONC \_\_\_\_\_
5. ZEANALY \_\_\_\_\_
6. PETERRINT \_\_\_\_\_
7. TADA \_\_\_\_\_
8. BRENSOSOAIV \_\_\_\_\_
9. CCOUNTD \_\_\_\_\_
10. SINGED \_\_\_\_\_
11. STABLEET \_\_\_\_\_
12. SISNANLY \_\_\_\_\_
13. RRREO \_\_\_\_\_
14. MUNNOCCIATE \_\_\_\_\_
15. STHEPYOISH \_\_\_\_\_
16. DREPIIONCT \_\_\_\_\_
17. EVERNOALUATI- \_\_\_\_\_
18. ASSESSMENTS \_\_\_\_\_

Draw a line to match the word with a synonym or short phrase.

- |                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>1. CONTROLS</li> <li>2. VARIABLE</li> <li>3. PREDICT</li> <li>4. RE-EVALUATION</li> <li>5. ERROR ANALYSIS</li> <li>6. HYPOTHESIS</li> <li>7. TESTABLE</li> <li>8. COMMUNICATE</li> <li>9. CONDUCT</li> <li>10. DESIGN</li> <li>11. OBSERVATION</li> <li>12. DATA</li> <li>13. INTERPRET</li> <li>14. ANALYZE</li> <li>15. COLLECT</li> <li>16. SCIENTIFIC</li> </ol> | <p>carry out</p> <p>tell others</p> <p>plan out</p> <p>can be tested</p> <p>look and record</p> <p>what you think will happen</p> <p>recordable fact</p> <p>find mistakes</p> <p>look at data again</p> <p>decide what data means</p> <p>find data patterns</p> <p>guesses about future results</p> <p>gather up information</p> <p>something that changes</p> <p>something that stays the same</p> <p>a method used for experiments</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Fun with Vocabulary Words, part 2

|               |                |          |            |
|---------------|----------------|----------|------------|
| control       | error analysis | conduct  | interpret  |
| variable      | hypothesis     | design   | analyze    |
| predictions   | observation    | testable | collect    |
| re-evaluation | communicate    | data     | scientific |

Use the words from the text box to fill in the blanks.

1. The \_\_\_\_\_ method uses experiments.
2. When you \_\_\_\_\_ an experiment you start with a \_\_\_\_\_, or your guesses.
3. The \_\_\_\_\_ does not change.
4. In an experiment your hypothesis has to be \_\_\_\_\_.
5. When you look at data for patterns, you \_\_\_\_\_ and \_\_\_\_\_.
6. When you look at your experiment, you do a \_\_\_\_\_ of the data and then do an \_\_\_\_\_.
7. Writing up your report is one way to \_\_\_\_\_ your results to others.
8. The way you set up your experiment is the \_\_\_\_\_.
9. When you run your experiment and write down the data, you are \_\_\_\_\_ing data.

Use the remaining four vocabulary words in sentences.

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## Answers to *Guide to Science Experiments*

### Ralph's basketball experiment, page 2

- Problem: Ralph is missing too many free shots.  
Hypothesis: If he holds his hands like Javon does, he will improve.  
What: If Ralph is better holding his hands like Javon does.  
Design: They each take 20 shots. Javon shoots all 20 balls his way.  
Ralph shoots 10 balls his way, and 10 Javon's way.  
Control: Ralph shoots 10 his way—no change.  
Variable: Ralph uses Javon's way of shooting.  
Collected: Coach records it on a chart as they shoot.  
Results: Javon 18/20 his way  
Ralph 7/10 his way                      10/10 Javon's way  
Analyze: Ralph got more baskets shooting Javon's way.  
It is better for him to use Javon's way.  
Discussion: Javon and Ralph think changing Ralph's hands will improve his shot.  
Coach is not sure.  
Re-evaluation: Maybe Ralph should take more shots.  
Error Analysis: Maybe they should look at all of Ralph's missed shots to see if there is anything else wrong with his shooting.  
Additional re-evaluation items: Answers vary by student, but may include such as: Maybe they should check it out during a game.

### Nat and Alonzo's class party, page 4

- Problem: Nat and Alonzo want to know what kind of food the class likes.  
Hypothesis: They will like something other than Nat's favorite.  
What: Four menus for food for the party.  
Design: Nat and Alonzo have the class vote on four menus.  
Control: Nat's favorite—hot dogs with salsa, blueberry muffins, orange soda-pop.  
Variable: Three other choices.  
Collected: The class takes a survey and Nat and Alonzo tally it.  
Data and Results:    Meal 1:        2  
                          Meal 2:        16  
                          Meal 3:        5  
                          Meal 4:        8  
                          Meal 5:        9  
                          Total votes: 30        Winner: Meal 2  
Analyze: The class wants Meal 2 by over ½ of the votes.  
Nat's favorite was the least popular.  
Discussion: Nat was wrong about his choice and it was good to take a survey or everyone would be disappointed in the food.  
Re-evaluation: Nat and Alonzo need to find out what kind of popsicles the class wants and need to do another survey.  
Error Analysis: Maybe there are classmates who do not eat meat.  
Maybe if they been more specific, people would have voted differently.

**A Doggone Experiment, page 6**

Problem: Spike is not eating his food.  
Hypothesis: He does not like the brand of food he has been eating.  
What: Will Spike eat if he has different food?  
Design: Each day for five days, Spike will be given a different kind of food to eat.  
Control: One of his choices will be his regular food.  
Variable: Spike will be given four new kinds of food to eat.  
Collected: Mom puts out the food and keeps track of if he eats it that day.  
Results: Spike ate Canine Cuisine and Pop Dog foods.  
Analyze: Spike will eat either Pop Dog or Canine Cuisine but not his regular food.  
He will eat if he has different food.  
Discussion: Spike is not eating because he does not like his regular food, but he also does not like two other kinds. He might be a fussy eater.  
Re-evaluation: Mom says to do another experiment to see if he likes Pop Dog or Canine Cuisine the best.  
Error Analysis: Spike might like other kinds of food too.  
Additional re-evaluation items: Answers vary by student, but may include such as: Spike may have been sick prior to or during the experiment.

**The Stain Game, page 8**

Problem: Melody needs to get a big ketchup stain out of her jacket.  
Hypothesis: One of the 4 stain removers will work better than not treating it at all.  
What: Four kinds of stain remover for getting out the spot  
Design: Four pieces of cloth are treated with the four different spot removers.  
They are soaked for 6 minutes and tested.  
Control: Cloth with stain that is not treated at all  
Variable: Hairspray, shampoo and salt  
Collected: Melody records it on a chart.  
Data and Results:     Nothing       stain out?     No  
                          Hair Spray    stain out?     A little  
                          Shampoo     stain out?     All out  
                          Salt           stain out?     No  
Analyze:       Shampoo works the best with hairspray in second place.  
                  Salt, or no treatment, do not remove the stain at all.  
Discussion:    Melody will wash her coat after treating the spot with shampoo.  
Re-evaluation: Mom says they should have just tried to spot clean it with detergent.  
Error Analysis: Maybe one of the choices should have been detergent. Maybe it should have soaked longer.  
Additional re-evaluation items: Answers vary by student, but may include such as: They did not use a spray spot remover.

**Word Games, page 10**

Problem: Jon is not passing vocabulary tests and has no good way to study.  
 Hypothesis: A different study method will be more helpful to Jon.  
 What: Four different ways to study.  
 Design: The three boys will teach Jon using their methods for one week. He will take a test and see which method worked best.  
 Control: Jon's original way of studying.  
 Variable: Three different ways to study.  
 Collected: Jon takes a test and they look at the words he got right.  
 Data and Results: **Jon's original method: 5/10, or 50%.**

| <b>Al's method</b> | <b>Marvin's method</b> | <b>Matthew's method</b> |
|--------------------|------------------------|-------------------------|
| 9/10 90%           | 2/10 20%               | 5/10 50%                |
| FIRST (WINNER)     | THIRD (LAST)           | SECOND                  |
| LISTENING          | LOOKING                | WRITING                 |

Analyze: Jon did better with listening. His way was as good as Matthew's way and Marvin's way was the worst for him.  
 Discussion: Jon should try to study using the listening methods for his test.  
 Re-evaluation: Jon thinks the other ways of learning could help him if he did two at a time or if he used it for different subjects like spelling or math.  
 Error Analysis: Jon may not have tried hard with Matthew's way.  
 Additional re-evaluation items: Answers vary by student, but may include such as: Maybe he just needs to study harder or more often using all of the methods.

**Puppy Trouble, page 12**

Problem: Two puppies do not come when called and need to be trained to do this.  
 Hypothesis: The puppies can be trained by giving them treats or jerking them.  
 What: Whether they come better if given treats, or jerked and pulled.  
 Design: The puppies will be called using the jerk and pull way in the morning and the treat way at night for 7 days.  
 Control: The treat way to call them.  
 Variable: The jerk and pull way to call them.  
 Collected: Grandma will record the data on a chart daily and total up the results.

Data and Results:

| <b>Jerk and pull</b> | <b>Treats</b> |
|----------------------|---------------|
| Romper 0/7           | Romper 7/7    |
| Bumper 1/7           | Bumper 7/7    |

Analyze: The puppies come better when given treats. They came every time when given treats and only Bumper came once when jerked and pulled.  
 Discussion: The girls should continue using the treats way to train the dogs. The dogs do not come well when jerked and pulled.  
 Re-evaluation: Test the puppies separately so they do not copy each other.  
 Error Analysis: The dogs may copy each other.  
 The 2nd dog called just copies and may not do it one his own.  
 Additional re-evaluation items: Answers vary by student, but may include such as: The girls could look in books for other ways and try them out.

**Do It Yourself – The Track Meet, page 13**

Problem: The track team is not increasing their speed, but must in order to win more meets.

Hypothesis: There are different training methods to increase speed.

What: Three ways to train for speed

Design: The team will train for one week with running 3 miles, one week with speed drills and one week with weights. At the end of each week they will be timed.

Control: Running three miles.

Variable: Speed drills or weight training

Collected: The coach will time them at the end of each.

Data, Results, Analysis, Discussion, Re-evaluation, Error Analysis, Additional re-evaluation items: Will vary according to student's "results." Check for accuracy. If preferred, instructor may dictate a set of "results" and grade based on student response.

**Do It Yourself – Test Ear, page 14**

Problem: Ty has a bad earache and does not want to go to the doctor.

Hypothesis: Grandma's olive oil treatment will work the best.

What: Two ways to treat Ty's earache—cotton balls with olive oil or drinking mint tea.

Design: Ty will drink mint tea 3 times a day for 2 days, and then he will put cotton balls with olive oil on them for 2 days.

Control: The cotton ball way

Variable: The mint tea way

Collected: Mom treats Ty and writes the results down on a chart.

Data, Results, Analysis, Discussion, Re-evaluation, Error Analysis, Additional re-evaluation items: Will vary according to student's "results." Check for accuracy. If preferred, instructor may dictate a set of "results" and grade based on student response.

## **Answers to *Fun with Vocabulary Words***

### **Unscramble**

1. COLLECT
2. VARIABLE
3. SCIENTIFIC
4. CONTROLS
5. ANALYZE
6. INTERPRET
7. DATA
8. OBSERVATION
9. CONDUCT
10. DESIGN
11. TESTABLE
12. ANALYSIS
13. ERROR
14. COMMUNICATE
15. HYPOTHESIS
16. PREDICTION
17. RE-EVALUATION

### **Matching**

1. something that stays the same
2. something that changes
3. guesses about future results
4. look at data again
5. find mistakes
6. what you think will happen
7. can be tested
8. tell others
9. carry out
10. plan out
11. look and record
12. recordable fact
13. decide what data means
14. find data patterns
15. gather up information
16. a method used for experiments

**Fill-in-the-blanks**

1. scientific
2. conduct, hypothesis
3. control
4. testable
5. interpret, analyze
6. re-evaluation, error analysis
7. communicate
8. design
9. collect

**Sentences**

Students should use the words Predictions, Observation, Variable, and Data.

**Multiple Choice**

1. c
2. d
3. c
4. b
5. b
6. c
7. c

**Short Answer**

1. If you use the scientific method, you know you are using a method that is proven and correct. You will conduct your experiment in the right order.
2. The control variable gives you an element in the experiment that will not change and will show you what would happen in the experiment if you did not change anything.
3. You want to do a re-evaluation to make sure you did not miss anything that would change your results. It looks for mistakes and things you may have left out of the experiment that could change your results.