**Practice B**

**Surveys, Experiments, and Observational Studies**

**Explain whether each situation is an experiment or an observational study.**

1. A teacher asks her students to write down all they eat in a day and then calculate the total number of calories consumed.

2. A marine biologist visits a certain beach in Florida every year and counts the number of eggs in sea turtle nests.

3. The cafeteria manager of a high school wants to find out if high prices are keeping students from using the cafeteria. Fifty students are chosen at random to receive half-price lunch passes every day for a month. The manager then records the number of passes used.

**The study described below is a randomized comparative experiment.**

**Describe the treatment, the treatment group, and the control group.**

4. A medical researcher collects data about a certain medicine. She asks 10 patients to take the medicine and another 10 patients to take a placebo (a sugar pill known to have no effect). None of the patients knows which group he or she is in. At the end of 6 months, the group taking the medicine showed more improvement in their symptoms than the group taking the placebo.

5. A department store wants to increase its sales. It assembled 100 of its best credit card customers and randomly divided them into two groups of 50. One group was allowed to use a special website for ordering goods and paying bills and the other group was not. At the end of six months, the group using the special website made 40% more purchases than the control group.

**Explain whether the research topic is best addressed through an experiment or an observational study. Then explain how you would set up the experiment or observational study.**

6. Does getting less than 7 hours of sleep per night affect how students perform in their morning classes?

7. Do people who take zinc as a dietary supplement each day have fewer colds than people who do not take zinc supplements?
Problem Solving
1. Observational study; the park ranger gathers data without controlling the individuals or applying a treatment.
2. Experiment; the park ranger applies a treatment (planting near the lake) to some of the individuals (all 20 trees the ranger planted).
3. Observational study; the zoo applies a treatment (providing the cave) to some of the individuals (all wildcats at the zoo).
4. Observational study; the caretaker gathers data without controlling the individuals or applying a treatment.
5. The treatment is feeding high-fat and high-calorie foods. The treatment group is the rats that were fed the diet that was not nutritious. The control group is the rats that were fed the nutritious diet.
6. The treatment is taking the class online. The treatment group is the online class. The control group is the in-person class.
7. Possible answer: It would not be ethical to impose the treatment (being a smoker) to a group of people, so the study is best addressed through an observational study. I would set up the study by randomly selecting a group of 20 people who already smoke and 20 people who do not. Then, I would track the individuals in the study for a year and have them report the number of colds they get.

Practice B
1. Observational study; the teacher gathers data without controlling the individuals or applying a treatment.
2. Observational study; the biologist gathers data without controlling the individuals or applying a treatment.
3. Experiment; the cafeteria manager applies a treatment (getting a half-price lunch) to some of the individuals (50 students).
4. The treatment is getting a certain medicine. The treatment group is the 10 patients who get the medicine. The control group is the 10 patients who get the placebo.
5. The treatment is using a special website. The treatment group is the 50 best customers who use the special website. The control group is the 50 best customers who do not use the special website.
6. Possible answer: The treatment (getting 7 hours of sleep) is not practical to assign to a group of students. Perform an observational study. Divide students into two groups: those who get less than 7 hours of sleep, and those who get at least 7 hours of sleep. Monitor the performance of students in both groups at regular intervals.
7. The treatment (taking a zinc supplement) is both practical and ethical because it is not known to have any negative effects.
Perform an experiment. Possible answer: Randomly choose one group of seasonal cold sufferers to give the supplement to. Randomly choose another group of seasonal cold sufferers that are untreated. Monitor the number of colds in both groups at regular intervals.

**Practice C**

1. Observational study; the guidance counselor gathers data without controlling the individuals or applying a treatment.

2. Experiment; the manager applies a treatment (moving the display to the front of the store) to the subject of the study (the display of items) and compares a characteristic of interest (how well the items sell) before and after the treatment.

3. Observational study; the researcher gathers data without controlling the individuals or applying a treatment.

4. The treatment is introducing background noise. The treatment group is the 10 people who completed the tasks while subjected to background noise. The control group is the 10 people who completed the tasks in a quiet room.

5. The treatment is paving roads with the new asphalt. The treatment group is the 3 roads that were paved with the new asphalt. The control group is the 3 roads that were paved with the old asphalt.

6. The question is best addressed by an experiment because the treatment (offering non-members access to computers) is neither impractical nor unethical. I would set up the experiment by tracking new library memberships over 3 or more months. Then, I would advertise and begin offering the access to non-members. I would again track new memberships over the number of months and compare the numbers.

**Reteach**

1. Observational study; the teacher gathers data without controlling the individuals or applying a treatment.

2. Experiment; the park employee applies a treatment (introducing breeding pairs of wolves) to some of the individuals (the park population of animals).

3. Observational study; the researcher gathers data without controlling the individuals or applying a treatment.

4. The treatment (adding a chemical food additive) may be unethical if it causes headaches. Perform an observational study; Possible answer: Randomly choose a number of people and assign them to two groups. One group already consumes food with the chemical additive while the other group does not. Gather data on which group reports more headaches.

5. The treatment in this study is providing students with graphing calculators. The treatment group is the class that was provided with graphing calculators. The control group is the class that was not provided with graphing calculators.

**Challenge**

1. Method 1: experiment; Method 2: survey; Method 3: observational study. Method 1 is most reliable; Method 2 and 3 depend on finding farms using the desired fertilizers, and different farms may use different amounts of fertilizer.

2. Method 1: observational study; Method 2: experiment; Method 3: survey. Method 3 is most reliable; Method 1 and 2 require waiting for cavities to develop, which could take years.

3. Method 1: experiment; Method 2: observational study; Method 3: survey. Method 1 is most reliable; Method 2 may not be random, and Method 3 relies on the drivers accurately remembering their battery usage.

**Problem Solving**

1. The teacher applies a treatment (playing music during tests) to some of the individuals (the class). This situation is an example of an experiment.