

Chapter I: SCIENTIFIC METHOD

Unit 2: The Scientific Method

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The basic scientific method includes the steps scientists use and follow when trying to solve a problem or prove or disprove a theory. The methods are used by scientists all over the world. This is done so scientists can work together to solve some of the same problems.

There are usually five steps which are a part of the scientific method. The steps can occur in any order, but the first step is usually observation. An observation is the use of one or more of the five senses, which include seeing, hearing, feeling, smelling, and tasting. The five senses are used to learn about or identify an event or object the scientist wants to study. For example, while observing a spider a scientist may observe the pattern or size of the spider's web.

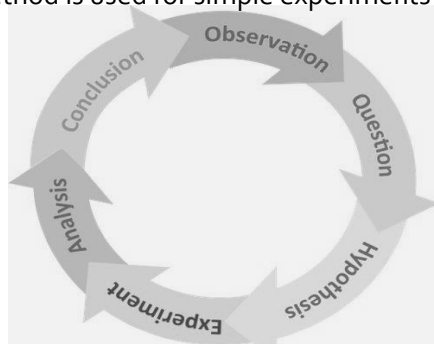
The second step of the scientific method is the question being researched, the hypothesis. It is the question that is turned into a statement about an event or object the scientist would like to research. A good hypothesis includes three things: The explanation for the observations, it is able to be tested by other scientists, and it will usually predict new outcomes or conclusions. The scientist observing the spider building the web may have a question about the strength of the web. An example of the hypothesis might be: The larger the spider, the stronger the web. This hypothesis includes the explanation for the observation, it can be tested, and new conclusions may be reached.

The third step of the scientific method is the experiment. An experiment is a test which will either challenge or support the hypothesis. The hypothesis will then be true or false. Using the spider hypothesis, a scientist may experiment by measuring spider webs in relation to a spider's size. Often, even when a hypothesis is disproved much can still be learned during the experiment. For example, while measuring the strength of spider webs the scientist may discover something new about them.

The final step in the scientific method is the conclusion. The conclusion will either clearly support the hypothesis or it will not. If the results support the hypothesis a conclusion can be written. If it does not support the hypothesis, the scientist may choose to change the hypothesis or write a new one based on what was learned during the experiment. In the example, if the scientist proves that larger spiders build stronger webs, then that is the conclusion. If it was not proven, the scientist may change the hypothesis to: The size of a spider does have no bearing on the strength of its web.

The scientific method is used for simple experiments students may do in the classroom or very complex or difficult experiments being done all over the world. The spider experiment may be done by any scientist in the world.

In summary, the scientific method includes the steps scientists use to solve a problem or to prove or disprove a theory. There are four basic steps involved with the scientific method. The usual steps include observation, hypothesis, experiment, and conclusion. The steps may not always be completed in the same order. Following the four steps, the results of the experiment will either support the hypothesis or will not support the hypothesis. Scientists are always free to change or write a new hypothesis and start the four steps all over again. The scientific method is used for simple experiments or for more difficult experiments.



Tick the correct answer

A. Which of the following is the best definition of the scientific method?

1. A method used by scientists to try and find the answers to questions.
2. Used by scientists only throughout the world.
3. A method to prove the right answer to a question by a scientist.
4. The steps scientists use and follow when trying to solve a problem or to prove or disprove a theory.

B. Which of the steps in the scientific method would a scientist use for seeing, hearing, feeling, smelling, and tasting?

1. Conclusion
2. Observation
3. Experiment
4. Hypothesis

C. Which of the following is the best example of a hypothesis?

1. Do hamsters live longer than birds?
2. Cars and trucks usually use the same amount of gasoline.
3. I think dogs make better pets for everyone.
4. Brand B lightbulb will burn longer in a lamp than Brand X lightbulb.

D. Which statement is true?

1. An experiment is a test which will either challenge or support a hypothesis.
2. An experiment is a test which must always prove the hypothesis.
3. An experiment is only used when trying to prove a hypothesis.
4. An experiment does not have to be part of the scientific method.

E. Fill in the blank with one of the choices. If the results of an experiment support the hypothesis a (n) _____ can be written.

1. Observation
2. New hypothesis
3. Conclusion
4. Experiment

F. The scientific method

1. Can be used for simple experiments or more difficult experiments
2. Can be used only for simple experiments at home or in the classroom
3. Can only be used for experiments carried out by scientists
4. Can only be used for very difficult experiments

Vocabulary

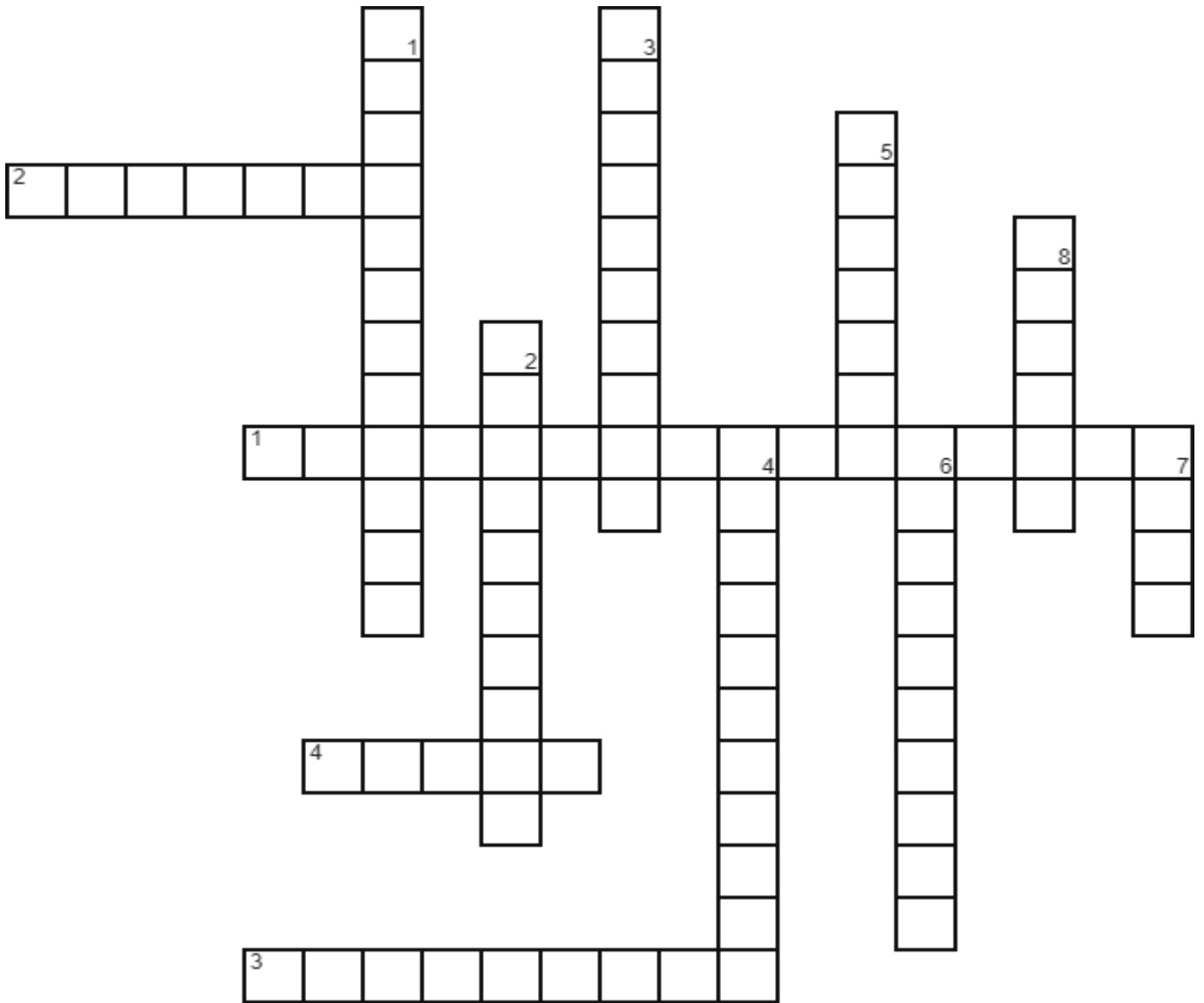
Cross

1. The ___ is a process used by scientists to find answers to questions or solve a problem.
2. After the experiment, scientists organize and ___ the data
3. The ___ variable is the part of the experiment that is affected by the independent variable.
4. Sometimes scientists make a mistake or ___ and need to do an experiment again

Down

1. Scientists make ___ to help them make a hypothesis or collect data during an experiment.
2. After an experiment the scientists write a ___ which summarizes their experiment and results

3. The ___ is an educated guess.
4. The ___ variable is the part of the experiment that is being tested or the part that is changed by the person doing the experiment.
5. The first step of the scientific method is to define or identify the ___
6. After the scientist makes a hypothesis, they perform an ___ to collect data.
7. The information collected during an experiment is called ___.
8. Scientists use their data to make charts and ___ to communicate the results of an experiment.



GRAMMAR

Relative Clauses

Meaning and use

Relative clauses are used to give additional information about a noun, such as a person, place or thing. **Relative pronouns** introduce a relative clause. They include **who** for people, **that** and **which** for things, **when** for time, and **whose** to show possession.

Relative clauses belong to one of two categories: **defining** relative clauses and **non-defining** relative clauses.

1. Defining relative clauses

- They add **essential** information to a sentence.

*The woman **who found my wallet** handed it in to reception.*

*The student **whose dog has run away** has gone to look for it.*

*I remember the day **when we first met**.*

*These are the earrings **that my mother gave me**.*

- These clauses give **essential** information about the subject of the sentence. They define the **person, time** or **thing** that we are talking about. If we remove the clause, the sentence does not make sense.

Non-defining relative clauses

They add **extra** information to a noun or noun phrase.

*My friend's birthday, **which was last weekend**, was great fun.*

*My current girlfriend, **who I love very much**, calls me every night.*

This extra information is **not essential**. If we remove the clause, the sentence still makes sense. This type of clause is more common in written English.

Form

- **Defining relative clauses** are made with **noun + relative pronoun + rest of clause**.

*A kangaroo is **an animal which lives in Australia**.*

***The man who came for lunch** was my uncle.*

*Winter is **a time when it sometimes snows**.*

- **Non-defining relative clauses** are made in the same way. An important difference, however, between both types of clause, is the use of **punctuation**. With **non-defining** relative clauses, we separate the clause with **commas**. We cannot use **that** in this type of clause.

*My favorite food, **which used to be Italian**, is now Japanese.*

*Rachel, **who we met yesterday**, lives in this neighborhood*

Take note: replacing the relative pronoun

In **informal** communication, relative pronouns, such as **who** and **when**, are commonly replaced with **that** in defining relative clauses.

*The woman **that** called last night was very polite.*

*Do you remember the time **that** you first met?*

Take note: leaving out the relative pronoun

When using defining relative clauses in **informal** speech and writing, the relative pronoun can be **left out completely** if it refers to the **object** of the relative clause.

*This is the shirt **that** I bought.*

This is the shirt I bought.

*The girl **who** I like isn't here yet.*

The girl I like isn't here yet.

In **non-defining** relative clauses, the relative pronoun **cannot be left out**.

Take note: spoken English

The relative pronoun **WHO** is used when referring to people. However, in **formal** written and spoken English, if the pronoun refers to the **object** of the clause, we use **WHOM** instead.

*My German teacher, **whom** I really admired, retired last year.*

*The woman **whom** I called this morning was my secretary.*



Tick the right option

1. I cannot remember the reason _____ he wanted us to leave.

Why ()

Nothing ()

Which ()

When ()

2. She's the most hard-working student _____ I've ever had.

Nothing ()

Who ()

That ()

Which ()

3. The company gave a promotion to John, _____ department performed best last year.
Nothing () Who () Which () Whose ()
4. I didn't get a pay raise, but this was not the reason _____ I left.
That () Which () Nothing () Why ()
5. I went to the party _____ I was going to see Mark.
That () Nothing () Where () When ()
6. We don't know all the guests _____ were invited to the party.
That () Nothing () Which () Who ()
7. Do you know the man _____ lives across the street?
Who () Whose () Which () Nothing ()
8. The party _____ was organized by Mary gave us much pleasure.
That () Nothing () Which () Whose ()
9. Do you remember the date _____ we have to submit the essay?
When () Nothing () That () Which ()
10. Jane, _____ mother is a physician, is very good at biology.
Who () That () Nothing () Whose ()
11. He handed me the money _____ I dropped.
That () Which () Nothing () Where ()
12. The woman _____ is sitting at the desk is Mr. White's secretary.
Nothing () Who () Whose () That ()
13. We bought this map, _____ helped us a lot.
Nothing () Which () Who () That ()
14. The book _____ you gave me yesterday is very interesting.
That () Who () Which () Nothing ()
15. The woman _____ I spoke to was very helpful.
Nothing () Who () Which () That ()
16. I gave him all the money _____ I had.
Which () Whose () That () Nothing ()
17. Jack, _____ parents died when he was two, was adopted by the Smiths.
Which () Who () Nothing () Whose ()
18. Edgar Allan Poe was a writer _____ wrote scary stories.
Who () Whose () That () Nothing ()
19. Do you know the restaurant _____ Stephen picked me up?
Which () That () Nothing () Where ()
20. 1964, was the year _____ my mother started her career.
Why () Nothing () Which () When ()

Link both sentences with the proper relative pronoun if necessary

1. Last month we climbed a really steep mountain. Many people couldn't climb it in the past.
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2. Don't tell off children too much. Above all if they get very low marks.

3. Bus nº 14 will take us to the lake. We are waiting for that bus.

4. Have you ever been to 'Maison du Mer'? It lies at the end of the street.

5. Have you got a screw driver? I can use it to fix this toy.

6. I never listen to many things. People like talking about many things.

7. She is Jane Presto. She wins all the races in the school.

8. That Chinese restaurant is very good. We always eat in that restaurant.

9. I am interested in magic books. Those books are on the top shelf.

10. I saw a boy standing near the harbor. His name was Richard.

Rewrite the following story. Include the extra information on the right by using relative clauses.

One day, Philip K. Wrigley was sitting on a plane. During the flight, the man asked, "Why do you continue to advertise a chewing gum?" Wrigley quickly replied, "For the same reason that the pilot of this plane keeps the engines running."

- ✓ He was the founder of the famous chewing gum company.
- ✓ It was flying to Chicago
- ✓ The man was sitting next to him.
- ✓ It is already the most popular in the world.
- ✓ He was known for his wit.
- ✓ It is already 30.000 feet in the air.
