

WORD GENERATION - SCIENCE UNIT 6.6

READY TO CONDUCT YOUR OWN **INVESTIGATION?**

FOCUS WORDS

device
conduct
testable
initial
investigate
determine



SCIENCE CLASS SESSION I

Focus Words:

device | conduct | testable | initial | investigate | determine

Erin scanned the crowded cafeteria and saw her friends Clara and Jose sitting at a table near the window. She quickly joined them, claiming the last empty seat at the table.

Clara: Hey Erin! Didn't you try out for the gymnastics team yesterday? How did it go?

Erin: It was really awful. I had to do all of these jumps and flips, which was fine. But sometimes the coach wanted me to land on one foot. I was not happy. I fell every time.

Clara: I'm sorry. That sounds really bad.

Erin: I just have no balance. I guess I'll never be on the team.

Jose: Don't think like that. You know what? I think I can help you improve your balance!

Erin: Really?

Jose: Really. So, last year my cousin got this special bracelet for Christmas which is supposed to help with balance. It had magnets or something in it. She said it helped her so much that she made the dance team on her first try.

Clara: Jose, do you actually believe that was why she made the team? How can a bracelet make you a great dancer?

Erin: I don't know. But, what if it really works?

Clara: I bet it's just another one of those silly things that people tell you on TV so they can take your money. Last year my dad bought some machine that was supposed to make his stomach flat. He still has a belly and the device is now in the closet.

Erin: How can a company say that? How can they make a claim like that without proof? I'm sure the company selling the bracelet tested it to see if it really did help improve balance.

Jose: Well, I've got my evidence. It worked for my cousin, and that's enough for me.

Clara: I'm not so sure that the company **conducted** the kind of experiments that would prove the bracelet helps with balance. There are so many variables that can affect a person's balance. For example, I had an ear infection two weeks ago. One morning I almost fell getting out of bed because I was so dizzy. My Mom said that your inner ear plays a role in balance, which seems strange to me.

Erin: Well, why don't we conduct our own test? Let's buy a bracelet and see if it works under different conditions.

Erin believed that the claim that the bracelet could improve balance was definitely testable, and that conducting the test would show the bracelet worked. Clara was still skeptical, and Jose realized they might have a problem.

Jose: We could do an initial test with one bracelet, but I think in the end we'd have to test more than one of them and my cousin said they are expensive.

Clara: I think we will be better off if we investigate how other variables might affect Erin's balance in the tryouts. One variable could be the food you eat. It could be that your balance was off because you were feeling weak. Maybe all you needed was to eat breakfast. Another variable could be the amount of sleep you get. Maybe you didn't get enough sleep the night before the tryouts.

Erin: You really think there are that many variables that can affect balance? Variables-such a great word!

Clara: Of course. All we need to do is figure out, I mean determine, what might help you improve your balance so you make the gymnastics team.

Jose: Let's all investigate. And Erin, just remember, we can always buy you a bracelet if nothing else works!

The friends decided that they would investigate variables that might improve a person's balance. They made a plan to meet the next day.



Comprehension Questions

Use the text on the previous page to **determine** what each character thinks. Circle the correct answer.

- I. What does Clara think?
 - a) She thinks the bracelet company conducted the proper experiments to determine if the device works.
 - b) She thinks the bracelet company should display their findings at a science conference.
 - c) She thinks there are many variables that can affect a person's balance.
 - d) She wants to make the gymnastics team so she wants a bracelet.
- 2. What does Jose think?
 - a) He thinks the bracelet has been tested many times so it must work.
 - b) He thinks if the bracelet helped his cousin make the dance team, it must improve balance.
 - c) He thinks the company did not **conduct** proper testing to find out if the bracelet works.
 - d) He thinks the bracelet will help him make the dance team.
- 3. What does Erin want?
 - a) She wants to buy the bracelet if it will help her make the gymnastics team.
 - b) She wants Jose to lend her money to buy a bracelet because it is expensive.
 - c) She wants to do tests to get a better sense of reaction times.
 - d) She wants to meet Jose's cousin to ask for more details about how the magnetic bracelet helped her make the dance team.



For example: "I would like to test the claim that a certain toothpaste really makes your teeth whiter."



Coming up:

Scientists do large amounts of research on a topic before they have enough data to make a claim. Once they gather data, they often present their research at a conference where other scientists can learn from them. They display their work on posters and give presentations about the experiments they have **conducted**. Scientists can then get suggestions and comments from others in their field and this improves their research.

Your team will be **conducting** your own experiment to **investigate** what might affect a person's balance. Your team will **display** and present your work to the rest of the class in a conference at the end of the week.



SCIENCE CLASS SESSION 2

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Scientists ask questions all the time, but some are **better for investigation** than others. When you come up with a question for an investigation, think about **two things**.



FIRST: Is the question testable?

In science, some questions are **testable** while others are too general to be tested. Scientists are often interested in general questions, but they learn about these by studying **testable** questions. A **testable** question is one where you ask whether changing one thing will have an effect on another. A **testable** question must be *specific* and be about variables that are *measurable*.

Look at the two examples below. These are examples of **testable** vs. untestable questions. Look closely at the differences between the two.

Untestable Question	Testable question	Why is the question testable?
How do plants grow?	Will adding fertilizer make plants grow taller?	What you change: add fertilizer
		What could happen: the plant might grow taller
What prevents ice from melting?	What is the best insulator to keep ice from melting	What you change: the insulator materials
		What could happen: the ice might melt slower

ACTIVITY: Look at the questions in the chart below. The first two questions are done for you. Fill in the chart for the remaining two questions.

	Why is the question not testable?	Can you make a testable question about this same subject?
→ Does a fish get angry if you take away its food?	This is not testable because we have no way to measure fish anger.	Do fish lay fewer eggs when they have less food?
→ Will dogs be affected by the weather?	This is not testable because it is not specific enough.	Does a dog shed more hair when the weather is warmer? Hint: This question is better because it asks specifically about what hannens in warm weather.
→ Do plants like water?		Itappens
→ Will sleep affect a student?		



Remember, some questions are better for investigation than others. After you have formulated your **testable** question for an investigation, there is a second thing to think about.



SECOND: Do you have the materials and time to conduct your investigation?

Remember when Erin wanted to **investigate** the magnetic bracelets to see if they improved balance, and Clara pointed out that they didn't have any bracelets and buying them would be expensive? This is an example of not having the right materials needed for an investigation. When coming up with an investigation, make sure you have all the materials you need and that you have enough time to **conduct** the experiment.

ACTIVITY:

Here are some examples of investigation questions about balance. Do these questions meet the requirements for an investigation that can be carried out in our classroom this week? Look at the example in the first box. Write your answers in the boxes below.

Remember, the questions must:

- I. be TESTABLE.
- 2. be something we have the TIME and MATERIALS to investigate.

our two requirements?		Why or why not?
Can people balance on one foot longer if they are standing in a swimming pool?	∏ yes Øno	The questions is testable but we don't have a swimming pool in the classroom.
Does eating a power bar affect your balance?	□ yes □ no	
Can people balance on one foot longer if they practice every day for a year?] yes] no	
Does being sick make your balance worse?] yes] no	

Does this question meet

On the previous page, you looked at examples of questions for investigation and evaluated whether they were **testable**, the materials were available, and there was sufficient time to **conduct** the experiment. Now it is your team's turn to come up with an investigation about variables that affect balance. Your **initial** step is to come up with a question for investigation. Your team will work on your investigation for the rest of the week and will present results to the class at the end of the week during the conference.

Here is the process that your team will follow to prepare:

• What is your investigable question about balance? Remember that it needs to be **testable**, and you need the right materials and enough time to **conduct** your investigation.

Our question about balance is:

SCIENCE CLASS

SESSION 3

Here is an example from a previous unit: Will people be able to balance longer on one foot if they move their arms than if they keep their arms still?

2. Write a scientific hypothesis statement about balance that addresses your question. Remember that a scientific hypothesis statement includes: a) a view based on what you know or think and b) a reason or a cause that you can test with a measure.

Our hypothesis about balance is:

Here is an example from a previous unit: People will react faster to a dropped ruler if they use the hand that they write with because that hand is stronger than the non-writing hand.

3 Think about your procedure for your experiment. (You will write your procedure on the next page.) Remember: In science class, a good procedure includes:

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- The number of times you will repeat the procedure
- Information about labeling and recording the data

Units of measurement that are precise, so you or someone else could repeat the procedure exactly (e.g., use 10 grams instead of "a little bit" or "some")

4. List the materials you will need for your experiment:



Now, write your procedure STEP by STEP:

How **detailed** should your procedure be?

GOOD QUESTION! Study this procedure from a previous unit to find out:

- Explain to the person that you will be testing reaction times for both hands.
- 2. The person testing holds a ruler at the top and lets it hang vertically.
- 3. The person catching the ruler holds up the hand he or she writes with and positions it directly below the bottom of the ruler.
- 4. The person holding the ruler lets go and the test person tries to catch the ruler as quickly as possible.
- 5. On the data table, record where the person caught the ruler.
- 6. Repeat this two more times for the hand the test person uses to write.
- Repeat the whole procedure three times for the hand that the person does not use to write with.
- 8. Compare the distances that the ruler fell.

Next, **conduct** your experiment and record your data.

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What's a data table? GOOD QUESTION! Study this one from a previous unit to find out.	Trial Number	Distance ruler fell (cm) Writing hand	Distance ruler fell (cm) Non-writing hand
	1	7	11
	2	7	12
	3	6	10

After your team has completed data collection, write a claims, evidence, reasoning statement based on the results of your experiment. Remember to look for patterns in your results to help you make your claim.

In writing your statement, be sure to answer the following questions:

- What can your team claim about the data?
- What is your evidence to support your claim?
- What reasons can you give to connect your evidence and your claim?

What does a claims, evidence, reasoning statement look like?

GOOD QUESTION! Study this one from a previous unit to find out. We claim that reaction times are faster when people use their writing hand. Our evidence is that when we tested catching a ruler with each hand, the distances were smaller when a person used their writing hand. We think a reason for this might be that the hand you write with gets

more use, and gets faster with practice.

Our Statement:



Scientists sometimes present their work at conferences. In a similar way, each team in your class is now responsible for presenting your work to other students. Focus on the variables you tested that might affect a person's balance. To do this, your team will make a poster that displays the findings of your investigation. Be sure to include everything that is shown on the model below: DOES HOLDING YOUR BREATH AFFECT BALANCE? DATA TABLE HYPOTHESIS AND PROCEDURE Claims, evidence, reasoning statement Ideas for future experiments Before your presentation, think about one more question: What is a possible criticism of your investigation? One criticism might be: _____

SCIENCE CLASS

SESSION 4

At conferences, scientists have a chance to ask each other questions about their research. Like them, each team will have a chance to listen to the investigation results of other teams. After you have listened to a presentation, your job is to come up with one general comment for each team as well as one question for clarification about how they conducted their investigation. Work together to come up with one question and one comment for each team.

SCIENCE CLASS

SESSION 5

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Example of comments and questions related to an experiment you did in a previous unit:

Comment: I really liked your procedure. You did a good job making sure to use multiple trials. Question: Do you think if people practiced catching the ruler with their non-writing hand that their reaction times would get better?

For Team I	
Comment:	
Question:	
For Team 2	
Comment:	
Question:	
For Team 3	
Comment:	
Ouestion:	
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F	
For leam 4	

Comment:

Question:

I Can Read Your Mind (Really!)

ELA ACTIVITY

during science focus week

In the popular *Twilight* book series, vampire Edward Cullen can read minds. He uses this ability to protect himself and the people he cares about. The only thoughts he cannot read are those of the girl he loves. Likewise, in the *Harry Potter* series, Harry must learn to protect his mind from those who could use his thoughts to harm him or others. Fantasy authors like J.K. Rowling include mind reading to capture the imagination of their readers. But is mind reading about to move out of the fantasy world of wizards and vampires and into the real world of science and medicine?

Focus Words

- device
- conduct
- testable
- initial
- investigate
- ▶ determine

Scientists who study the brain have been **conducting** tests to **investigate** thinking brains. For over 50 years, scientists and doctors have been using electrodes to measure brain activity to **determine** what part of the brain "lights up" when people do or think about

something. One question that has always been a bit mysterious to scientists is what changes in the brain when we think about different words (or ideas). Do our brains send different signals when we think different words? Initial investigations using new computer software suggest that thinking of the word "cat" produces different brain activity from thinking of the word "bat." In fact, this new technology can tell us which word a person is thinking. So in a way, technology is making it possible to read people's minds! As scientists learn more about this technology, they may be able to create devices that help people do things just by thinking. For example, people who are paralyzed may be able to move



artificial limbs just by thinking words like "grip" and "lift." A person who has lost the ability to speak may be able to communicate with just his thoughts.

Some questions that were once untestable become **testable** because we have new technologies. What question would you like to see answered if only it were **testable**? Can you imagine a technology that would make it **testable**?

http://www.npr.org/2011/05/12/135598390/mind-reading-technology-turns-thought-into-action http://science.howstuffworks.com/science-vs-myth/everyday-myths/large-hadron-collider.htm http://public.web.cern.ch/public/en/lhc/lhc-en.html

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Human balance can be affected by many variables, but did you know that your ears play a role in balance? **Initially**, scientists thought that the ear was only important in allowing people to hear. In the late 1800s, a scientist named Ernst Mach began **investigating** the human ear. He **conducted** a series of experiments and **determined** that a part of the inner ear was responsible for helping humans balance. Your ears have many tiny pieces in them but each piece does a very big job.

Option I

One part of your outer ear is the auditory canal ("audio" means sound), and it is very small. Only 3.5 cm long! How long is that in meters?

A) 35 meters

- B) 3.5 meters
- C) 0.35 meters
- D) 0.035 meters

Option 2

There are certain types of doctors who specialize in helping people who might have problems with their balance. These doctors treat the diseases that affect the inner ear and cause people to have problems balancing. One particular disease affects 0.05% of the population in the United States. If the current population of the U.S. is 312 million people, how many are affected?

Discussion Question:

Some people suggest that practicing can help you to improve your balance. Gymnasts and dancers train for years to be able to stand on one foot, land a jump, or dance on their toes. For people with diseases that affect balance, this is not enough. There are companies that are **investigating ways to** improve balance for these people using different kinds of **devices**. One company in particular is designing a vest that would help with balance. How do you think these companies should test whether these **devices** work? What kind of experiments can they **conduct**?

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SOC ST ACTIVITY during science focus week

In 2010, famous athletes Shaquille O'Neal and David Beckham took part in a new fad for boosting athletic performance. They wore the Power Balance bracelet. Kate Middleton, now the wife of Prince William, also wore the bracelet. The makers claimed that the bracelet improved energy and balance. However an investigation of the product revealed that it did not have any real effect. In 2011, the company had to pay millions of dollars in a settlement with unhappy customers.

Snake Oil Salesman

In the 1800s, railroad workers from China used oil made from Chinese water snakes to relieve pain. This remedy may have brought some relief to the



sore muscles of railroad workers. As a result, hundreds of "snake oil salesmen" displayed their version of snake oil throughout the country. The claims of these products were not **testable** at the time. There was no way for people to **determine** whether they contained any oil from the Chinese water snake. By the time their customers realized that the product was a scam, the snake oil salesman was on his way to a new town!

In 1906, the government passed a law to protect people from ineffective or dangerous products. Businesses must now **conduct** multiple trials on certain health products to demonstrate that they are safe and effective. This law improved safety **initially**, but now businesses have figured out ways to evade the law by relabeling products without health claims.

Buyer Beware

Some companies still take advantage of people. They know that many people will spend money on products that promise to make them look and feel better. From **devices** for flatter stomachs to a cure for acne, many of these advertised products are no more effective than the Power Balance bracelet. People continue to get scammed by modern day snake oil salesmen. Some people think that the government needs to take a larger role in protecting people from these miracle cures.

Others think that companies should be able to do what they want in order to sell their products. They think that consumers are responsible for determining if a product's claim is realistic. They believe that people are to blame if they buy a product that claims to be a miracle cure.

What do you think? Do you believe that the government needs to take a larger role in protecting people from modern day snake oil salesmen? Or do you think that businesses should be able to make money by selling miracle cures?

Focus Words

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FOCUS WORDS UNIT 6.6 - SCIENCE FOCUS

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→ *	Focus Word and Definition related word	Example of Use
\rightarrow	to investigate <i>verb</i> to try to figure out the truth about something by learning more about it	When Janine said the dryer wasn't working, her mother went to the basement to investigate .
*	investigation <i>noun</i> the process of trying to find out the truth about something by carefully studying the details	Popular TV shows like C.S.I. and JAG entertain viewers with exaggerated details from the investigation of crimes.
\rightarrow	testable <i>adjective</i> able to be tested using procedures, measurements, and data to find out answers	The view that teens who play violent video games are more likely to commit violent acts is testable .
\rightarrow	to conduct verb to carry out a procedure or task	Scientists who conduct several trials produce better data than those who are satisfied with conducting a single trial.
\rightarrow	device <i>noun</i> a machine that does a specific task or job	The grocery store installed a device on its shopping carts that prevents people from stealing them.
\rightarrow	initial <i>adjective</i> happening at the beginning before other things occur	My initial response to the field trip to the museum was excitement; however, I was less excited when my teacher assigned a five-page report on the exhibit.
\rightarrow	to determine verb to find out the facts about something	The fire chief determined the source of the fire was old electrical wires.
*	determined adjective not giving up	My friend was determined to find the best wheels for his skateboard.

