UNIT 6

# In the Lab

## WHAT DO YOU ALREADY KNOW?

**1 IN GROUPS Think about these areas of research. Are they all equally important?**

- finding a cure for cancer
- studying distant galaxies
- researching the effects of climate change

## THINK AND PREPARE

**2 Do you agree or disagree with this statement?**

*Scientists should solve real-world problems and not just do pure research.*

**3 IN PAIRS Prepare a panel discussion where you will present your ideas. You are members of a college panel discussing how to use this year's research budget. You are choosing between two projects to fund. Some of you support one project and some of you support the other. The two projects are:**

- a search for exoplanets, outside our solar system
- research into the effects of traffic pollution on children

Consider these points:

- the cost of the project
- the possible short-term benefits of the project
- the possible long-term benefits of the project

**VIDEO**

Watch the video as you prepare for the panel discussion, and find out how to best use your voice.

## SPEAK YOUR MIND

**4 Hold your panel discussion for the class.**

**In this unit, you will …**

- brainstorm the qualities of a successful student and discuss academic honesty.
- focus on Mediation: simplify information for different levels of fluency.
- focus on a Thinking Skill: interpreting.
- read about the ethics of scientific research.
- learn about openness and how open you are to new experiences.
- read about analytical thinking and the professions that use this skill.

## LIFE SKILLS openness

**A Read the definition of openness. In what ways is openness important to you in your personal, academic, and professional life?**

Openness is the ability to accept new ideas or methods. People who have a high level of openness are imaginative and curious. They find new ways to solve problems, and they are often described as able to "think outside the box." This is an advantage when they are involved in research and innovation.

**B Check (✓) the statements you agree with. Then compare with a partner.**

- ☐ Science is about hard work and careful planning.
- ☐ You need good luck to be successful in science.
- ☐ A scientist has to have an open mind.
- ☐ Scientists always know what to expect from their experiments.

**C 6.01 Read the article and answer the questions.**

# Chance Discoveries

People who don't work in scientific fields may think that all scientists follow the scientific method when they do research. When scientists want the answer to a question, they usually form a hypothesis and design an experiment to test the hypothesis. Then they carry out the experiment and reach a conclusion. If the hypothesis isn't **absolutely correct**, the scientists form a new hypothesis and the process continues. However, the scientific method doesn't include an important factor: luck.

Luck has played a large part in some of the most important scientific discoveries. For instance, luck played an important role when Sir Alexander Fleming discovered the first antibiotic, penicillin, in 1928. Fleming was studying bacteria when he noticed something **highly unusual**. A dish that had been left near a window had green mold growing on it. The mold seemed to kill the bacteria, which was a **totally unexpected** result. Fleming and his assistants did further tests and found that the mold produced a chemical, now known as penicillin, which killed the bacteria.

The discovery of X-rays and radioactivity also involved luck. In 1895, Wilhelm Röntgen was using a piece of equipment called a cathode ray tube. When Röntgen filled the tube with a special gas and connected it to an electric current, the tube produced ultraviolet radiation. The radiation made a screen covered with a barium (Ba) compound glow. By chance, Röntgen placed heavy paper between the tube and the screen, and the screen continued to glow. Röntgen discovered that X-rays (as he called them) went through objects!

A year after Röntgen's discovery, French physicist Henri Becquerel was studying X-rays using a chemical containing uranium (U). He thought sunlight made the chemical produce X-rays. He covered some photographic plates with black paper, put the chemicals on top, and left them in the sun. The image of the uranium crystals was on the plate. He thought his hypothesis was **absolutely right**. One day it was cloudy, so Becquerel didn't do any experiments. He put his chemicals and photographic plates in a drawer. By chance, he developed the photographs from the drawer, even though it was **highly unlikely** he would find an image. To his surprise, he saw the image of the crystals. He had discovered that the chemicals, not the sunlight, caused radioactivity. His hypothesis had been **completely wrong**.

Today, penicillin, X-rays, and radioactive chemicals are used in medicine around the world. The world would be a very different place if we didn't have them. Fleming, Röntgen, and Becquerel were all lucky, but they were also prepared. If they hadn't spent years in their laboratories, they wouldn't have had the expertise they needed to use their luck. In addition, they were curious and open-minded. As a result, they discovered things that other scientists had not noticed. Some people argue that **highly successful** people use these same skills in life, not just in science. If you have the right expertise and the right attitude, you will be able to make the most of your luck.

Read more

1 How was Fleming lucky? How did he take advantage of his luck?
2 According to the article, what skills are needed to be successful in science and other fields (besides luck)?

**D IN PAIRS Read the situations below. What is the opportunity in each situation? Discuss what might happen if you were open to taking the opportunity.**

1 You are at a party. You overhear someone talking about her studies. She is studying the same subject you are and looking for someone to join her research group.
2 You are at work. You hear that the company is looking for people to work in its new office in another city.

**E Discuss the questions as a class.**

1 On a scale of 1 (not very open) to 10 (very open), how open are you to new experiences?
2 Do you want to be more open to new experiences? If so, what can you do?
3 How might being open to new opportunities help you in your present or future career?

**MAKE IT YOURS**

Do you know any friends or family members who took advantage of luck or who were open to new opportunities in their field of study or business? Look online for words that could describe how they used those opportunities.

## VOCABULARY adverb + adjective collocations

**A Look at the article from LIFE SKILLS C. What part of speech is *totally*? What part of speech is *unexpected*?**

**B IN PAIRS Use the adverbs *absolutely*, *completely*, *highly*, and *totally* with the adjectives in the box. Make as many adverb + adjective pairs as you can.**

| | | | | | |
|---|---|---|---|---|---|
| accurate | correct | new | right | unexpected | unusual |
| amazed | different | perfect | successful | unlikely | wrong |

*absolutely correct, totally wrong,*

**C Ask and answer.**

1 Would you be completely happy to work in science? Or would you prefer to do something completely different?
2 What qualities do you need to be a highly successful scientist?

## GRAMMAR conditionals review

**A Match the excerpts from the article (1–4) to the meaning of each conditional sentence (a–d).**

1 If you have the right expertise and the right attitude, you will make the most of your luck. ____
2 If the hypothesis isn't absolutely correct, the scientists form a new hypothesis and the process continues. ____
3 If they hadn't spent years in their laboratories, they wouldn't have had the expertise they needed to use their luck. ____
4 The world would be a very different place if we didn't have them. ____

**a** a general truth
**b** a future possibility
**c** a hypothetical present
**d** a hypothetical past

**B Complete the table with the correct tenses.**

| Type of conditional | Sentence | Verb tense |
|---|---|---|
| Real conditions: Zero conditional | If you heat ice, it melts. | 1 *simple present* |
| Real conditions: First conditional | If you carry out this experiment, you will see some interesting results. | 2 _____ 3 _____ |
| Unreal conditions: Second conditional | If I were a scientist, I would like to work in a research lab. | 4 _____ 5 _____ |
| Unreal conditions: Third conditional | If I had been in Alexander Fleming's position, I would not have noticed the same thing he did. | 6 _____ *would (not) have* + past participle |

For more practice, go to page 166.

**C Write conditional sentences using the prompts. There may be more than one answer in some cases.**

1 work hard / can create / you / your own luck / if / you / . _____
2 you / if / have / you / will be / an open mind / more successful in your career / . _____
3 if / paid more attention / they / people / more lucky opportunities / might see / . _____
4 Fleming / life for the last hundred years / hadn't discovered penicillin / would have been / very different / if / . _____

**D Say if you agree or disagree with each of the sentences you wrote in C.**

## PRONUNCIATION intonation in conditionals

**A 6.02 Listen to this sentence. Choose the correct intonation.**

1 If I were a scientist, I'd research climate change. 2 If I were a scientist, I'd research climate change.

**B 6.03 Practice saying these sentences with the correct intonation. Listen and check.**

1 If you train as a scientist, you learn to expect the unexpected.
2 If you work hard, you'll pass your anatomy exam.

## SPEAKING

For more speaking practice, go to page 150.

**A What do you think leads to academic success? Look at the ideas in the box and write your ideas in your notebook. Then compare with a partner.**

| | | |
|---|---|---|
| ability to handle stress | curiosity | hard work |
| an open mind | family support | luck |

**B IN GROUPS Discuss these statements. Decide as a group whether you *Agree*, *Disagree*, or are *Not sure*.**

1 You have to have the right attitude to be successful. Agree / Not sure / Disagree
2 Successful people focus on being good at just one thing. Agree / Not sure / Disagree
3 Most successful people have been lucky in their lives. Agree / Not sure / Disagree

**C Share your answers with the class. Explain the reasons for your choices.**

## READING

**A Read this definition. Then answer the question.**

**ethical (adj):** involving the rules used for deciding what is right or wrong

Are there some things that scientists should not do for ethical reasons? If so, what are they?

**B** 6.04 **Read these two points of view. Then read the statements and choose *True* or *False*.**

### THE GREAT DEBATE

We asked our readers: Do we need more control over scientific research for ethical reasons? Here are the top two comments.

**Agree with more control over scientific research:**

"I think we need more control over the scientific research in progress today. Scientific discoveries are being made that are just too dangerous to be allowed. We need to monitor the latest research and guard against the dangers they present. For example, scientists are already able to create brain cells in a lab. What happens if genetic research leads scientists to create human clones—exact genetic copies of people? Will we be able to choose whether our children are tall, intelligent, good-looking, or athletic one day? Is that the kind of world we want to live in?

Unless we control scientists, they will do these things and more. Once that happens, it will be too late to stop it. We need to have clear ethical rules saying what scientists can and can't do. We have to let ordinary citizens make decisions about what should be allowed. Scientists can't be trusted to make decisions. Since their research is often funded by large organizations and businesses, there is pressure on them to produce results. Provided that we have clear international rules, we can prevent some of the worst experiments from being done for scientific purposes." — Nathan

**Disagree with more control over scientific research:**

"Nobody argues that scientists should be completely free to do what they want. Of course, there have to be some ethical rules in case someone decides to do something that is clearly dangerous, such as create a virus. However, there are far too many restrictions on scientific research these days. One such restriction is on stem cell research. If they had fewer restrictions, scientists might be able to get rid of some genetic diseases completely. Children would no longer be born with diseases such as sickle-cell anemia or hemophilia. People could become resistant to HIV. Scientists could develop these cures if they were allowed to carry out more experiments using stem cells.

This kind of work is often restricted because public opinion is against it. Sometimes people are against it for cultural reasons, and sometimes it's because they don't understand the nature of the research. For example, scientists who work in human cloning are generally not trying to recreate an existing human being, which is the way it's often presented in the media. They are trying to develop treatments for diseases. As long as there is no immediate danger, we should let scientists carry out their work without interference. If scientists hadn't continued their research in spite of ethical objections in the past, we would never have developed organ transplants or genetically modified plants. Both of those discoveries benefit millions of people every year." — Hannah

Read more

**GLOSSARY**

**genetically modified plants (n):** plants that have been changed using genetic engineering to alter their genes and produce a new type of desirable plant

**organ transplant (n):** the process of removing an organ from one person and surgically placing it into another person

**stem cell (n):** a cell that is taken from a person or animal at an early stage of development and is capable of developing into cells of any type

**virus (n):** a small organism that causes disease

According to Nathan, …

1 parents should be allowed to choose their children's characteristics. True / False
2 regular citizens should decide on ethical rules for scientists. True / False
3 scientists should be left to make decisions. True / False

According to Hannah, …

4 there should be no ethical rules controlling scientists. True / False
5 some useful research is prevented because of ethical rules. True / False
6 organ transplants and genetically modified plants are positive research developments. True / False

**C READING SKILL—Identify reasons Complete the sentences with each person's reasons for his or her opinion.**

Nathan

1 We need clear, ethical rules because _____.
2 We can't trust scientists to make ethical decisions because _____.

Hannah

3 There is a misunderstanding of genetics because of _____.
4 We have organ transplants and genetically modified plants now because scientists _____.

## VOCABULARY science word formation

**A Complete the table with the correct words. Check in a dictionary if needed.**

| Noun (thing) | Noun (person) | Verb | Adjective | Adverb |
|---|---|---|---|---|
| 1 | beneficiary | benefit | 2 | 3 |
| 4 | ******** | ******** | curious | 5 |
| 6 | 7 | develop | 8<br>9 | ******** |
| 10 | discoverer | discover | discoverable | ******** |
| gene<br>11 | 12 | ******** | 13 | 14 |
| medicine | 15 | ******** | 16 | 17 |
| science | 18 | ******** | 19 | 20 |

## GRAMMAR conditional conjunctions and phrases

**A Underline sentences in READING B with these conditional conjunctions and phrases.**

| | | |
|---|---|---|
| as long as | once | since |
| in case | provided that | unless |

**B Match each conditional conjunction to the correct meaning. You will use one meaning twice.**

1 as long as ____
2 in case ____
3 once ____
4 provided that ____
5 since ____
6 unless ____

a because it is possible that
b except if
c at the moment something happens
d only if
e because it is true that

For more practice, go to page 167.

## WRITING a for/against essay

**A Put the paragraphs in the correct order. Then match each paragraph to the correct essay parts below.**

**Should smallpox be destroyed?**

_____ **a** On the other hand, people of the opposite opinion argue that we need to study the smallpox virus to protect ourselves against other diseases. By studying the smallpox virus, we learn more about how vaccines work and how viruses respond to those vaccines. Since viruses change all the time, we never know when a new serious disease may appear. Our research on the smallpox virus helps to protect us against possible future epidemics.

_____ **b** In general, I tend to find the arguments against destroying the smallpox virus more convincing. The risk of the virus escaping is very small, and the research may be very important in the future. I do not believe that the smallpox virus should be destroyed.

_____ **c** Smallpox, which used to kill millions of people every year, has been eradicated in the wild. It survives in small amounts in two laboratories and is used for research purposes. Some people argue that the remaining samples of smallpox should be destroyed.

_____ **d** The main argument supporting this opinion is the claim that the virus is still a danger to humanity. There are two main fears. First, the virus could escape from the laboratory. This could be the result of a careless researcher, for example, or an accident such as an explosion. Second, the virus could be deliberately released or used as a weapon. In both cases, millions of people would die. The benefits of studying the virus are not worth the risk, some argue.

1 Introduction: Paragraph _____
2 Main points for destroying smallpox: Paragraph _____
3 Main points against destroying smallpox: Paragraph _____
4 Writer's opinion: Paragraph _____

**B Do you agree with the writer? Discuss as a class.**

**C Choose an essay question below. Write a four-paragraph for/against essay in your notebook. Use the essay in A as a model.**

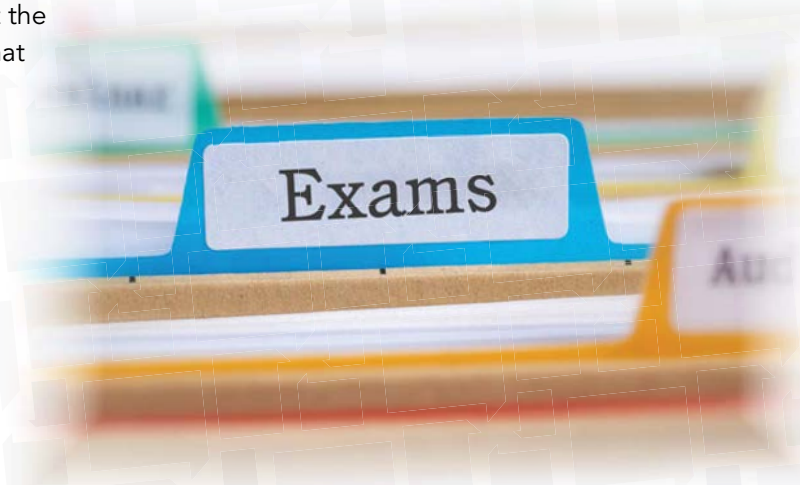
- Should people be allowed to choose their child's characteristics?
- Should other animals have the same rights as humans?
- Should society control the human population?

## SPEAKING

For more speaking practice, go to page 150.

**A Read the situation and possible courses of action. Check (✓) the courses of action you think would be acceptable in this situation.**

You are in the college dining hall when you overhear a conversation at another table. Two students from one of your classes are talking about an important test that is coming up. As you continue to listen, you realize that they are planning to break into your professor's office to get the answers to the test. It seems they are planning to do that the following night.




Possible courses of action:

- ☐ warn the students that you heard their plan
- ☐ tell your professor about the plan
- ☐ tell your classmates about the plan
- ☐ ask the students to share the answers with you
- ☐ do nothing

**B IN PAIRS Tell each other about the course of action you have chosen. Say what you think the consequences of each action might be.**

## VOCABULARY magnetism

**A** **Match the words to the definitions.**

1 
magnet

2 
compass

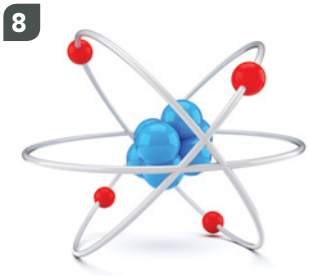
3 
wire

4 
hammer

5 
iron

6 
steel

7 
electric current

8 
atom

| | | | |
|---|---|---|---|
| **1** | A magnet is _____ | **a** | a tool used to hit something with force. |
| **2** | A compass is _____ | **b** | a metal; Fe. |
| **3** | A wire is _____ | **c** | the smallest unit of anything, with protons, neutrons, and electrons. |
| **4** | A hammer is _____ | **d** | a metal made of iron (Fe) and carbon (C). |
| **5** | Iron is _____ | **e** | a device used to show direction—north, east, south, west. |
| **6** | Steel is _____ | **f** | a long, thin piece of metal. |
| **7** | An electric current is _____ | **g** | the flow of electricity in motion. |
| **8** | An atom is _____ | **h** | a piece of metal that attracts other pieces of metal. |

## LISTENING

**A** **IN PAIRS** **Discuss ways we use magnets in everyday life.**

**B** **6.05 LISTENING SKILL—Identify key information** **Listen to a lecture about magnetism. Complete the notes with words and phrases.**

*Magnetism*

*magnet materials:* **1** _____, *especially* **2** _____ *or steel*

*3 ways magnets are made:*

*1 by* **3** _____*—e.g., use a hammer to hit a steel bar*
*must face* **4** _____ *in line with Earth's* **5** _____ *pole*
*works because you line up the* **6** _____

*2 use another* **7** _____
*need to move magnet along the* **8** _____ *in one direction*

*3 use an* **9** _____ *current*
*metals—magnetized because of their atomic structure*
*electrons can move in metals, not in* **10** _____ *or* **11** _____

**C** 6.05 **Listen again. Choose *True* or *False*.**

1 The center of the Earth is made of steel. True / False
2 The Earth acts like a giant magnet. True / False
3 A steel bar acts as a magnet when its atoms face different ways. True / False
4 To create an electromagnet, you need a piece of iron, a wire, and an electric current. True / False

**MAKE IT DIGITAL**

Go online and find out about other uses of magnetism. Then tell your classmates what you learned.

## THINKING SKILL interpreting

**A This graph shows the percentage of female college graduates in selected subject areas. Look at the graph and answer the questions below.**

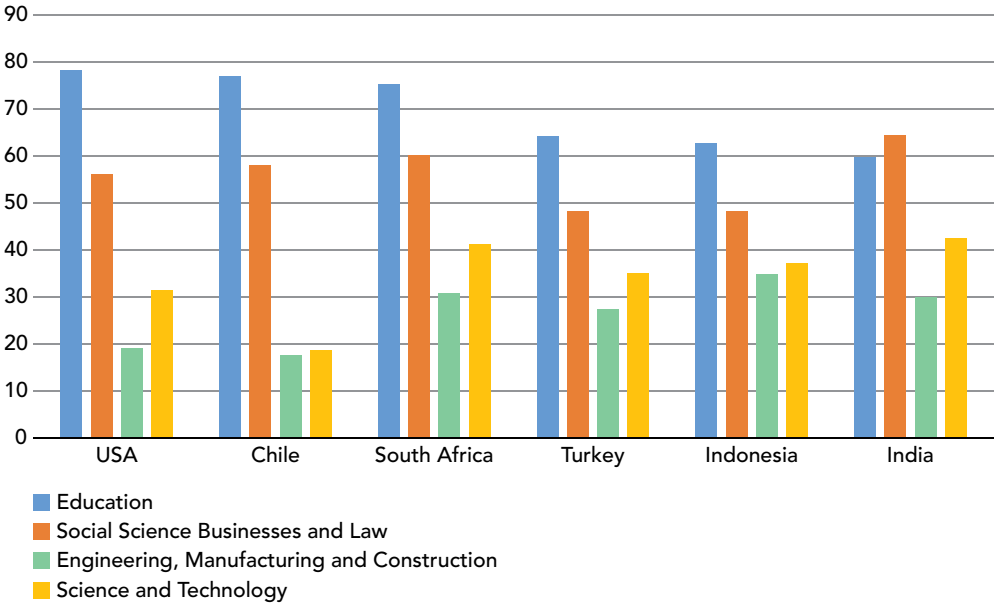



Figure 1: Percentage of female graduates from tertiary degrees in selected subjects (2014)

1 Which country has the highest percentage of female graduates in Science and Technology? Which country has the lowest percentage?
2 How does the percentage of female graduates for Social Sciences, Business, and Law compare to the precentage for Engineering, Manufacturing, and Construction in South Africa?
3 How do the percentages of female graduates for Education compare to the percentages for Science and Technology in all countries?
4 What statements are true for all countries?

**B IN PAIRS Discuss how the percentage of female graduates in science and technology might be increased. Talk about how effective each of these suggestions would be and add your own ideas.**

- teach about famous female scientists and engineers in high school
- avoid stereotyping men and women in specific careers when speaking with children
- teach what is involved in different scientists' roles
- show the social benefits of different scientific work
- invite female scientists to speak to high school students

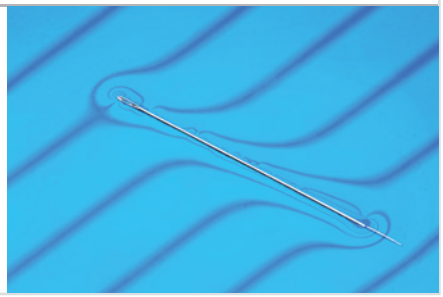
**C Share your discussion with the class.**

## MEDIATION CONFIDENT COMMUNICATOR simplifying information

**A Read the text and the conversation. Who makes the information in the text easier to understand? How does he or she do that?**

### Make Your Own Compass

To conduct the experiment, a needle and a magnet are required, along with a glass of water. In addition, a small piece of tissue paper is required. The needle is magnetized by rubbing the magnet along its length in one direction a number of times. The tissue paper is placed on the surface of the water and the needle is then placed on the tissue paper. When the tissue paper is pushed under the surface of the water, the needle continues to float due to surface tension. Since it is magnetized and free to float, the needle acts as a compass and lines up with the Earth's magnetic field. Note that the needle now points toward north.



**Victoria:** So, we're going to do this experiment. I have the instructions here, but it's a little complicated.
**Chris:** Yes, I know. It's not easy to understand.
**Emily:** Let's break it down into simple steps. First of all, we need a glass of water, a needle, a magnet, and some tissue paper. I have those things here.
**Victoria:** Good. What's the next step? I don't get what we have to do.
**Emily:** We need to magnetize the needle. In other words, we make it into a magnet. We do that by touching it with the magnet. Move the magnet in one direction. Do you understand?
**Chris:** Yes, I see. OK, I've done that. What's next?
**Emily:** Put the tissue paper on the water. Then put the needle on the tissue paper.
**Chris:** It's floating. Then the text says something about pushing it. I don't get that.
**Emily:** Use your finger to put the tissue paper under the water so it goes down. Now the needle is on the water.
**Victoria:** Is that it? I'm not sure what I'm learning from that.
**Emily:** The needle is a compass. This way is north.
**Victoria:** Oh, I see! We've made a compass. That's cool!

**B Read these tips on simplifying information. When might you need to simplify information for someone?**

When you need to simplify information for another person, it is helpful to follow these steps.

- Break the information down into smaller pieces. When you are simplifying instructions, break large steps down into smaller steps.
- Use clear language. Express the information in a simpler way, for example, by using the active voice instead of the passive voice or by using simple vocabulary.
- Check understanding. Make sure the other person understands before you move on to the next point or step.

**C IN GROUPS Read the instructions for another experiment. Role-play a conversation like the one in A. Take turns simplifying the information.**

### Make an Electromagnet

A nail, or any other similar object with a high iron content, is required, as is a length of copper wire. A power source, such as a battery, is needed. The wire is coiled around the nail a number of times. The more times the wire is coiled around the nail, the higher the strength of the electromagnet. The ends of the wire are then attached to the opposite ends of the battery. Testing the electromagnet can be done using small steel objects, such as paper clips. In addition to strengthening the electromagnetic force by increasing the number of turns in the wire, increased strength can also be achieved by using a stronger battery.


**D Discuss these questions.**

1 What steps from **B** did you use to simplify the information? Give examples.
2 What do you need to be careful of when you simplify information?

## VOCABULARY review

SCORE: / 10

**A Complete the text with the correct forms of the words in parentheses.**

It is certain that the **1** _____ (**discover**) of DNA was an important scientific **2** _____ (**develop**). It has led to **3** _____ (**complete**) new areas of research in the field of **4** _____ (**medic**), particularly when it comes to the treatment of **5** _____ (**gene**) conditions. However, some people think that there are dangerous risks if **6** _____ (**science**) are allowed to go wherever their **7** _____ (**curious**) leads them. The **8** _____ (**gene**) themselves may argue that unwanted consequences are highly **9** _____ (**like**) to happen, but the general public needs to feel confident that the research is going to be **10** _____ (**benefit**) to all and have few risks.

## GRAMMAR review

SCORE: / 10

**A Choose the correct words or phrases.**

1 If you drop a feather on the Moon, it **falls / would fall / has fallen** to the ground at the same speed as any other object.
2 If I had to work in science, I **will choose / would choose / would have chosen** an area like medicine so I could help people.
3 We wouldn't have had a problem if you **plan / planned / had planned** the experiment more carefully.
4 I think Isaac Newton **had developed / would not have developed / would develop** his theory of gravity if he hadn't seen an apple fall from a tree.
5 More girls would be interested in science if they **had / will have / would have** more female scientist role models.

**B Choose the correct words or phrases.**

1 The experiment will be fine **as long as / in case** we are very careful.
2 You'll be able to read the results of our scientific research **once / unless** it is published.
3 The editor of the science journal agreed to publish my article **in case / provided that** I made a few changes to the text.
4 You should wear protective glasses **in case / since** something goes wrong with the experiment.
5 More women won't enroll in college science programs **as long as / unless** we break down stereotypes.

16–20 correct: You can use science vocabulary and common adverb and adjective collocations.
You can use conditionals and conditional conjunctions and phrases.
0–15 correct: Look again at the Vocabulary and Grammar sections in the unit.

TOTAL SCORE: / 20

## SKILLS FOR PROS analytical thinking

Read this proverb. What do you think it means? How could you apply the idea in this proverb to your life or professional career?

**"The fish caught in the net starts to think."**

**—Zanzibar proverb**

Turn to **Skills for Pros** on page 138.

# SKILLS FOR PROS Analytical Thinking

**A Read about analytical thinking. Then choose *True* or *False*.**

## ANALYTICAL THINKING

We all need to solve problems and make decisions in our professional lives. Analytical thinking is the ability to approach a problem or a decision logically and systematically. When you use analytical thinking, you identify which features of a problem or a decision are important. This may involve slowly and meticulously identifying a number of possible causes of a problem, including ones that are not immediately obvious. If you are facing a decision, it may mean carefully judging the risks and benefits of different options. These processes help you break a complicated situation down into smaller parts. When you break a problem or decision down like that, it allows you to consider each part in detail. You can then compare different options or solutions systematically, perhaps by listing the pros and cons of each one. It also means you can recognize any problems in the information you have available to you. For example, two pieces of information you have about a problem may be inconsistent. Analytical thinking helps you to identify which information is likely to be accurate so that you can work toward a solution.

Analytical thinking plays an important role in a large number of different professions. Scientists in all fields use this kind of thinking regularly. For example, a team of scientists may get unexpected results from an experiment. They would probably start by checking for the most obvious immediate causes first, such as human error. After they confirm that the problem was not caused by someone making a mistake, they would then go on to consider the design of the experiment and any other secondary factors that may be relevant. Eventually, they will identify the cause of the problem and come up with a solution. This kind of thinking is also important in business. When a manager identifies a problem in his or her organization, such as a drop in sales or an increase in costs, analytical thinking is used to identify the cause, such as a need for staff training. Having identified the cause, the manager can then use analytical thinking to consider and compare various solutions, enabling him or her to make a logical decision. Lawyers also need this skill in order to work effectively with their clients. When a lawyer plans how to present a case before a judge, he or she needs to make many decisions about how different arguments relate to each other and to the evidence in the case.

Analytical thinking is important because a large part of professional life involves solving problems and making decisions. Good analytical thinking skills will make you more effective in your working life.

When you use analytical thinking, you …

1 consider the different parts of a problem at random. True / False
2 decide what is relevant to a problem or decision. True / False
3 solve problems quickly. True / False
4 consider small parts of a bigger problem or decision. True / False
5 can see when there are problems with the information available. True / False
6 find a solution when things don't work out as you expected. True / False
7 compare possible causes and solutions with each other. True / False
8 use a skill that is helpful in a variety of professions. True / False

**B IN PAIRS Discuss the questions.**

1 When you have a problem, is your first response to think analytically, or do you react in other ways?
2 Can you think of a time when you used analytical thinking? Explain what happened.
3 Are there any times when analytical thinking may not be appropriate?

**C IN GROUPS Read the situation and answer the questions.**

You work in a laboratory which develops experimental chemicals. You are carrying out an experiment with plants. The experiment involves giving some plants a chemical that should make them grow taller and stronger. However, some of the plants receiving the treatment are not growing in the way you expect. Some of them are very short, while others don't seem to be growing at all. There is also a set of control plants which has not received the chemical and the control plants have the same problem of not growing enough or at all. Before you talk to your supervisor, you would like to analyze the situation and discover the cause of the problem.

1 Which of the questions below would you ask to determine any immediate cause? Label the questions with the number 1.
2 Which of the questions below would you ask to determine other secondary causes? Label the questions with the number 2.

_____ Are the plants healthy or are there signs of disease?
_____ Have the plants been watered correctly?
_____ Have the plants received the correct amount of the chemical?
_____ Has anything in the laboratory affected the plants?
_____ Have the plants received the correct amount of light?
_____ Is the laboratory too cold or too hot?
_____ Are there other people with access to the plants?

3 What other questions could you ask to analyze the experiment results?

_____
_____
_____
_____
_____

4 How did you identify the key elements of the situation?

**D Discuss the questions as a class.**

1 Apart from the ones mentioned in the text, in what professions is analytical thinking particularly important?
2 In what ways is analytical thinking important in your studies or chosen career?
3 In what areas of your personal life can analytical thinking be useful?

## VIDEO WATCH THE VIDEO AND LEARN ABOUT ANALYTICAL THINKING

**E IN GROUPS Answer the questions.**

1 What is the definition of "analytical thinking"?
2 What types of careers require analytical thinking?
3 What are some examples of how analytical thinking is used in the workplace?
4 Why is analytical thinking important in these jobs?
5 What are the qualities of an analytical thinker?
6 What can you do to improve your analytical thinking skills?