Lesson 6.1 Stressed Out

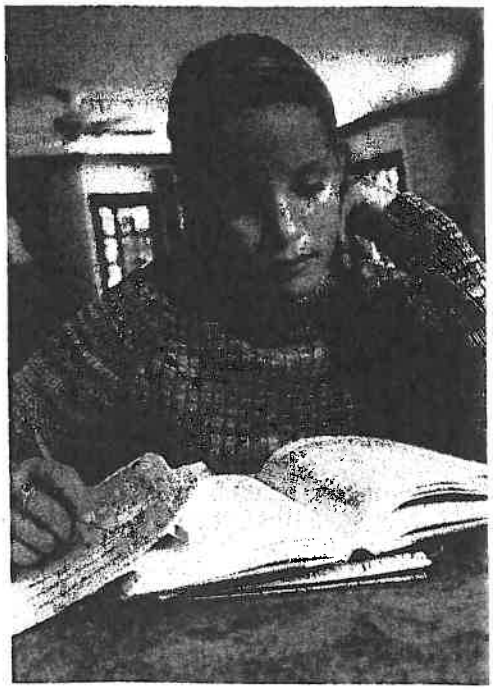
How do you handle the stresses in your life?

Everyone experiences stress. It's a basic human reaction to situations that make us feel fear or anxiety. Stress evokes a response known as "fight or flight"—an instinctual reaction to these feelings. When confronted with a predatory animal, for example, our early ancestors had to make a snap decision to fight to defend themselves or to flee to safety. The physical symptoms that are often linked to stress are actually the result of blood being redirected from its normal path towards the body's large muscles and more vital organs—a reaction that prepares the body to take action. Feelings of stress and worry served a purpose in the early days of human history, and they continue to do so today.

While most people view stress as something negative, there are positive aspects to it. Feeling a little stressed about a presentation you have to give can make you work harder and prepare better. More often, though, stress has a negative impact on our lives. It can make it difficult to learn and remember things, cause depression, and change relationships. Stress can even lead to serious health problems like high blood pressure and heart attacks. Studies have also linked stress to unhealthy eating habits, particularly of fatty foods. If a habit like this persists over time, it can lead to obesity, which is associated with higher risks of diseases like cancer and diabetes.

Recognizing the signs and symptoms of stress in yourself are important. The way people handle stress varies. Your sister may seem extra crabby when she's stressed, while a friend may withdraw and act depressed. Other common signs of stress are an increased heart rate, headaches, **insomnia**, stomachaches, grinding or clenching teeth, loss of appetite, tense muscles in the shoulders and neck, dizziness, and a dry mouth.

The causes of stress are endless, and like the symptoms, they vary from person to person. For adolescents, common worries are often school, relationships with friends and family, sports, and issues related to home life—like money, moving, or the health of a family member. Feeling as though these issues are outside of your control makes the feelings of anxiety more intense. That's why it's so important to remember that even when you can't control the situation, you can control how you react to it.



insomnia: difficulty sleeping

endorphins: chemicals produced by the body that are natural painkillers and create a feeling of well-being

There are lots of effective ways of dealing with stress. Here are a few examples:

- Talking to a parent or friend can help you remember that someone cares and you aren't alone.
- Deep breathing (in for a count of four, hold for a count of two, and out for a count of four) can help you relax.
- Exercising—whether it's going for a walk, playing basketball, or dancing—produces endorphins which can counteract feelings of stress.
- Spending time doing something you enjoy, like reading, listening to music, playing with a pet, or cooking, can take your mind off your troubles.
- Relaxation exercises offer quick results. Just contract and then release each muscle in your body, starting at your toes and working your way up to your head.

NAME _____

Circle the letter of the best answer to the question below.

1. Which of the following is not usually associated with high levels of stress?

   a. headaches

   b. insomnia

   c. feelings of contentment and well-being

   d. overeating or loss of appetite

Write your answers on the lines below.

2. Identify and list three sources of stress in your life.

   _____

3. Explain the "fight or flight" response.

   _____

   _____

4. Give an example of a time you experienced stress and explain how you handled it. Do you think it was an effective method?

   _____

   _____

5. What are three things in your life that you can do to reduce stress?

   _____

   _____

6. Why is exercise a good source of relieving stress?

   _____

7. In what ways can stress have a positive impact on your life?

   _____

8. Reread the last line of the selection. Then, give an example that illustrates it.

   _____

   _____

Lesson 6.2 Eating for Energy

Can the foods you eat help improve your athletic performance?

You've been training hard, and you want to be at peak performance for the softball championships. You've heard about foods, drinks, and supplements that can boost your performance, but you're not sure if they work. Do you know what you should eat to be at your best?

Good nutrition is as important to your body as all the training and practicing you do. The effects of good nutrition are **cumulative**, though, so eating well just before a competition isn't enough to keep your body healthy. The best way to consistently get the nutrition you need is by eating a balanced diet. Different foods offer different benefits to your body, which is why variety is so important.

To find out what foods you should eat and how many servings a day are recommended for someone your size, you can visit www.mypyramid.gov. If you are an athlete or you have periods of high activity, you may need to eat more than the suggested number of servings. The more calories you burn, the more you need to eat to replenish your energy levels.

Some athletes believe they need high-protein diets or supplements to build muscles. It's true that an athlete needs more protein because both muscle building and aerobic exercise can burn protein for energy. However, it's easy to add protein to your diet by eating extra fish, lean meats, beans, eggs, and nuts. Fresh, whole foods are the best source of nutrition.

Another popular practice for endurance athletes is called *carbo-loading*. An athlete eats few carbohydrates (like bread, pasta, and cereal) but lots of fats and proteins in the days before a competition. A day or two before the event, he or she eats lots of carbs to replenish the body's stores of **glycogen**. This practice can put unnecessary stress on the body. The better solution is to simply boost the amount of carbs you eat before a competition and reduce your workout time so that you have a good supply of glycogen ready when you need it.

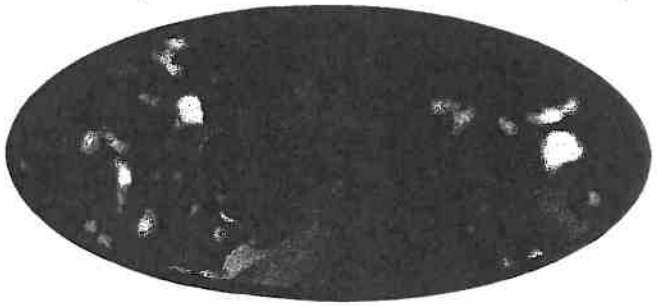
The best way to prepare your body for an athletic event is to eat a meal that's easy to digest three hours beforehand. Fats are hard to digest and sugary foods can cause your blood-sugar to soar and then plummet. Your best bet is a light meal that is high in starches—especially complex carbohydrates, like whole grains—and has a little protein. It'll fill you up and give you the energy you need to do your best.

cumulative: increasing through additions; formed by accumulation

glycogen: the form in which glucose (sugar) is stored in tissue, especially muscle

electrolytes: ions, like sodium and potassium, that regulate processes in the body and help cells communicate

Remember to drink lots of water before, during, and after exercising. The water you lose by sweating can cause your body to quickly become dehydrated. This is a serious condition that can lead to fatigue and heatstroke. In extreme circumstances, it can even lead to death. Drinking 6 to 8 ounces of cool water every 20 minutes or so while you exercise will keep your body hydrated. If you exercise for extended periods of time, you may want to try a sports drink that has sugars and electrolytes, which your body loses through sweat.



NAME _____

Write **true** or **false** next to each statement below.

1. _____ In general, athletes and non-athletes should consume the same number of calories per day.

2. _____ Fatigue and poor performance are the only effects of dehydration.

3. _____ It's important to drink water before, during, and after exercising.

4. _____ It is a myth that athletes need extra protein in their diets.

Use the words in the box to complete the sentences below.

glycogen	supplements	protein	hydrated

5. Drinking a glass of water about three times an hour during exercise will keep your body _____.

6. Fresh, whole foods are a better source of nutrition than _____.

7. Salmon, walnuts, and black beans are all good sources of _____.

8. A good supply of _____ can give your body the extra energy it needs to perform well.

Write your answers on the lines below.

9. Why is eating a variety of foods an important part of a nutritious diet?

_____

10. What benefits are there to having a sports drink that contains electrolytes when you're exercising for a long period of time?

_____

11. Give an example of a good meal to have before a sporting event and explain why.

_____

_____

12. In general, complex carbs are a better choice than simple carbs because they take longer to digest. Explain why you think this makes them a more healthful choice.

_____

Good Enough to Eat

How do you know that the food you eat each day is safe to consume?

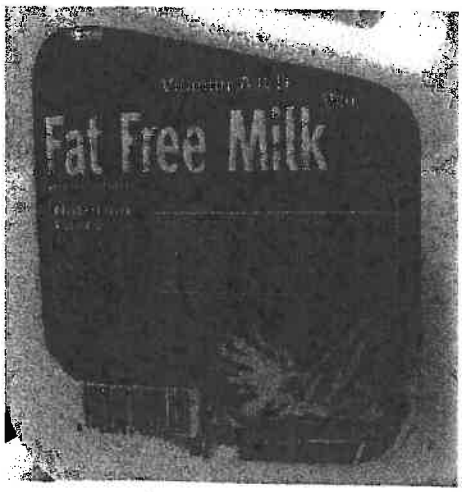
For breakfast, you have some cereal, milk, fruit, and juice. Then, you open up a bottle of water and take your antibiotics for a sore throat you had last week. As you're leaving for school, you grab some lip balm and smear it on. You may not realize it, but the United States government was responsible for making sure that each of those products you used was safe. More specifically, it was the responsibility of the FDA, an agency of the U.S. Department of Health and Human Services.

The FDA was created in 1906 when President Theodore Roosevelt signed the Food and Drugs Act into law. The purpose of the agency was to ensure that food wasn't spoiled and didn't contain fillers that compromised its quality, coloring that hid any problems with it, or **additives** that could be harmful. Similar criteria were applied to pharmaceutical drugs. The law also said that manufacturers had to be truthful about what their products contained and couldn't misrepresent any benefits.

In 1938, the Food, Drug, and Cosmetics Act was signed into law by President Franklin Roosevelt. It included stricter regulations and gave the FDA more authority. More than 100 people had died after taking a drug that wasn't properly tested. It was now the job of the FDA to ensure the safety of such products by doing further testing. Factory inspection became a part of the agency's duties, as did monitoring the safety of cosmetics.

Today, the food supply in the U.S. is one of the safest in the world. All aspects of the food industry are examined to make sure they adhere to safe practices and that their products are free of contamination. This includes any places where food is manufactured or packaged. It also includes places where food is served, like grocery stores, restaurants, and schools.

Part of the job of the FDA is to conduct research on food safety issues and educate the public about safe food practices. There are more than 75 million cases of **food-borne illnesses** that occur every year. Many of these cases could be prevented through proper handling, storage, and preparation of foods. The more people who are knowledgeable about safe food practices, the fewer illnesses and deaths will occur.



When a problem with a product does arise, it is the responsibility of the FDA to issue a recall. It informs consumers that there is a safety problem and advises them to stop using the product.

additives: small amounts of substances that change the properties of the material to which they're added

food-borne illnesses: illnesses caused by eating foods that contain bacteria, viruses, or toxins

Food, drugs, and cosmetics aren't the only products regulated by the FDA. Medical devices (like pacemakers), biologics (like vaccines), and radiation-emitting products (like microwaves) are also the agency's responsibility.

The FDA monitors foods that are imported from foreign countries to make sure they meet U.S. standards of safety. Even so, this can be difficult to do. In 2007, a massive pet food recall occurred. Manufacturing plants in China had included a substance called *melamine* as filler in pet foods. It isn't approved for use in food, but the plants didn't disclose that they were using it. It wasn't until animals began getting sick, and even dying, that the tainted food was traced to China.

NAME _____

Write your answers on the lines below.

1. Why was the FDA created?

_____

_____

2. What is a recall? What causes one to occur?

_____

_____

3. Why is educating the public an important role of the FDA? Be specific.

_____

_____

4. An emulsifier causes water and oil to stay mixed together instead of separating in products like mayonnaise and ice cream. It is an example of _____.

5. Give examples of three non-food products that are the responsibility of the FDA.

_____

6. The 2007 pet food recall occurred because manufacturing plants in China weren't disclosing all the substances they were using. Do you think the FDA could have done more to prevent something like this from happening? If so, how?

_____

_____

7. Not only does the FDA monitor foods intended for human beings, it also regulates animal feed and drugs. This is done partly for the safety of the animals, and partly for the safety of human beings. Explain how human beings might be affected by the foods animals consume.

_____

_____

What's Next?

The FDA is not responsible for all food products. Do some research to find out what foods are the responsibility of the USDA and why.

Lesson 6.4 What's in Your Closet?

How many purposes does your clothing serve?

Most people regard clothing simply as a form of covering for the body and an expression of personal style and taste. In today's world, however, clothing can be much more than a fashion statement. It can provide protection and combat environmental problems that our planet faces.

- Sun-protective clothing is rated for its Ultraviolet Protection Factor (UPF)—the protection it offers against **UVA and UVB rays**. A fabric that is rated 50 allows only 1/50 of the sun's UV rays to penetrate it. The color, tightness of the weave, and weight of the fabric all affect its ability to block the sun's harmful rays. While some clothing does this naturally, like a heavy, dark-colored denim shirt, it isn't what you'd want to wear on a warm summer day. Clothing that is marketed as sun-protective is treated with chemical sunblock that absorbs UV rays. After many washings, it loses its effectiveness.
- Clothing that repels bugs is a recent trend for manufacturers of outdoor gear. Instead of slathering on smelly insect repellent, you can simply wear clothing that keeps the bugs away. Pyrethrin is a natural bug repellent found in certain species of chrysanthemum flowers. A **synthetic** form, called *permethrin*, is imbedded into a special fabric that is used for outdoor clothing. It is safe and odorless, but like sun-protective clothing, it is less effective after repeated washings.
- Most people don't consider clothing as being harmful to the environment. However, many synthetic fabrics, like polyester, are made from petroleum. There is a limited supply of petroleum, which is a fossil fuel, and drilling for it and processing it require energy. Even producing clothes from natural materials, like cotton, can have a negative impact. Twenty-five percent of pesticides used in the United States are applied to cotton fields to keep them free of insects and weeds.

New options in clothing are becoming available, and studies are underway to create even more choices. For example, **polymers** can be made from corn sugars and then woven into thread to create fabric. Clothing can be made of recycled materials, like soda bottles or the waste from cotton mills. Some companies offer clothing made from bamboo pulp, because unlike cotton, bamboo doesn't need a lot of pesticides to grow.

While we can't predict all the changes to come in clothing, one thing is for certain—the world of fashion won't ever be the same.

UVA and UVB rays: waves of electromagnetic radiation produced by the sun

synthetic: artificial; human-made

polymers: long, chainlike molecules found in organic substances like protein and wood; also used in the creation of synthetic materials, like plastics and fibers

For people working or traveling in extremely cold conditions, having the proper protective clothing is essential. The layer closest to the body wicks away moisture due to perspiration. The next layer must provide insulation to keep the body's heat from escaping. Polar fleece is a popular material for this layer because it is warm and dries quickly. The outer layer must be hydrophobic (which literally means "scared of water") and able to resist strong winds. A popular choice for this layer is a synthetic material that lets water vapor escape without allowing any moisture to penetrate it.

NAME _____

Write **true** or **false** next to each statement below.

1. _____ No clothing is sun-protective unless it contains a chemical sunblock.
2. _____ Both insect repellent clothing and sun-protective clothing are effective for only a limited number of washings.
3. _____ The most environmentally-responsible clothing is made of pure cotton.
4. _____ Clothing that is hydrophobic absorbs water.
5. _____ Nylon is an example of a synthetic material, while silk has a natural source.

Write your answers on the lines below.

6. Explain what role fossil fuels play in the creation of some fabrics.

_____

7. What effect do cotton crops have on the environment?

_____

_____

8. Why is bamboo potentially a good alternative to cotton?

_____

9. If you were asked to use science to create a new type of clothing, what would you make and why?

_____

_____

10. What benefits are there to making clothing out of recycled materials?

_____

_____

11. What purpose does each layer of extreme-weather clothing serve?

_____

_____

Creating a Healthier World

eradication: elimination

developing countries: countries that have a high level of poverty and low standard of living

immunizing: injecting with a vaccine in order to create immunity to an illness

"Our greatest concern must always rest with disadvantaged and vulnerable groups. These groups are often hidden, live in remote rural areas or shantytowns and have little political voice."
—Dr. Margaret Chan, Director-General of WHO

In 2002 and 2003, an epidemic of a contagious respiratory disease called *SARS* infected more than 8,000 people and caused over 700 deaths. The outbreak originated in China, but the Chinese government did not inform WHO about it for several months—one reason why the disease spread to other countries. Once WHO became aware of the situation, they were able to set up procedures for dealing with patients, and implemented screenings at airports and quarantines to prevent further transmission.

Why is it necessary to have a global health agency?

The World Health Organization, known as WHO, is an agency of the United Nations. It began operating in 1948, three years after the formation of the UN. It has 193 member states and is headquartered in Geneva, Switzerland. Though the organization has many goals, its primary mission is to improve the health of people worldwide.

One of WHO's greatest accomplishments is the **eradication** of the smallpox virus. Smallpox is a highly contagious disease that is often fatal. Scientists believe that it first entered the human population more than 10,000 years ago when people began living in larger communities with the birth of agriculture. Because it is so easy to transmit, outbreaks of smallpox throughout history have wiped out large percentages of populations. This was particularly the case when Europeans arrived in the New World. After an aggressive vaccination campaign—with a focus on **developing countries**—WHO was able to declare that smallpox was eradicated in 1979. It was the first disease to be eliminated through human effort.

In addition to continuing efforts at **immunizing** people around the world, especially children, WHO's aim is to improve conditions that affect health—including sanitation, housing, nutrition, and working conditions. Poverty contributes to poor health, and poor health, in turn, prevents people from being able to pull themselves out of poverty. By working to make sure that people aren't denied access to health care or treatments because of their circumstances, WHO intends to break the cycle.

When AIDS was first identified in the early 1980s, WHO funded research to determine what caused the disease and how it was transmitted. Their research and search for a cure continues as they work to slow its spread. A great deal of incorrect information about its causes and how it is transmitted exist around the world. As a result, efforts by WHO and other organizations have focused on education, prevention, and counseling.

While rates have declined in some areas, they are still rising in others. About two-thirds of the people who currently have HIV (the virus that causes AIDS) live in sub-Saharan Africa. Combined with extreme poverty and the other health issues that exist there, the area is one of the neediest in the world. For these reasons, Dr. Margaret Chan, WHO's Director-General, has made the health of women and Africans a measure of the organization's success.

NAME _____

Circle the letter of the best answer to the question below.

1. Which of the following statements about WHO is not true?

   a. Vaccination of children around the world is one of WHO's priorities.

   b. WHO is an international organization, with representatives from nearly 200 nations.

   c. It is WHO's mission to help those who cannot help themselves.

   d. Because of WHO's vaccination campaign, SARS is no longer a threat.

Write your answers on the lines below.

2. How do you think that human beings' use of agriculture affected the spread of diseases?

3. What are two reasons why the eradication of smallpox was such a significant event?

4. If the primary goal of WHO is to improve health, why is the organization concerned with issues like housing, sanitation, and working conditions?

5. Why do you think it is important to have an international agency that deals with global health?

6. Why would the health of women and Africans be a measure or an indicator of the success of WHO?

7. Why is education an important part of WHO's mission? Be specific.

The Orbiting Junkyard

What is space junk, and where does it come from?

Just as it does on Earth, human activity in space generates waste. Orbital debris, or "space junk," comes from many sources. Satellites are often abandoned once they're no longer useful. Spacecraft separations release nuts, bolts, and other parts into orbit, and astronauts lose tools that are awkward to hold with their bulky gloves. The majority of the junk, however, has been generated by more than 200 explosions that have occurred in space, usually as a result of testing new rockets or other spacecraft.

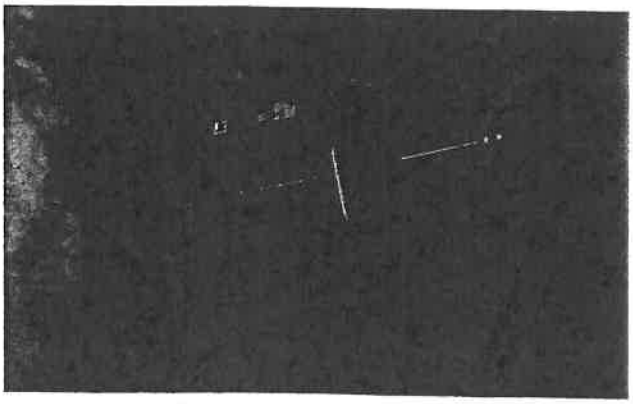
About 200 new pieces of space junk are added each year. This debris is not just slowly drifting through space. Space junk zips along at **velocities** ranging from a few hundred miles an hour up to 21,000 miles per hour. At those speeds, even small flecks of paint have been known to damage space shuttle windshields. In fact, more than 80 space shuttle windows have been replaced due to impacts with debris.

A lot of space junk eventually succumbs to Earth's gravitational pull and reenters the atmosphere. Like small meteorites, this debris usually burns up, but sometimes fragments survive. They often land in water, but large objects have also come close to hitting residential areas on land.

The U.S. Space Command tracks space junk by radar in order to avoid collisions with spacecraft. Even so, the equipment can only detect pieces larger than baseballs up to 600 miles high, and larger than volleyballs beyond that. In order to ensure the International Space Station has a clear path, NASA is investigating the use of high-powered lasers that could gently nudge pieces toward the atmosphere. Simply blasting the debris isn't an option because it would result in smaller particles that couldn't be tracked.

The best way to minimize the threat of space junk is not to create it. For example, **deployment** procedures can be used that don't require the ejection of objects, and tools can be **tethered** so that they don't drift away. A satellite can be designed to have a decaying orbit that slowly brings it into the atmosphere where it will burn up when it's no longer needed.

In recent years, an increasing number of satellites have been put into orbit as part of global communication systems. These satellites are vulnerable to impacts with pre-existing space junk, and any collision just creates more debris. The threat to astronauts and spacecraft—and even to people on the ground—has become a problem that can't be ignored.



velocities: rates and directions of movement

deployment: the act of positioning something so that it is ready to be used

tethered: attached by a rope or cable

In 2007, astronaut Clay Anderson was assigned to take out the trash from the International Space Station. In a carefully planned maneuver, he was held away from the space station by a robotic arm, and then he pitched the junk at a precise angle that carried it away from the craft and toward the atmosphere. NASA is tracking this garbage and expects it to burn up sometime in 2008.

A wrench, a glove, cameras, and even a toothbrush are among the objects astronauts have lost during space walks.

In January 2007, a single explosion during the testing of a satellite created 1,900 pieces of space junk large enough to be tracked by radar.

NAME _____

Circle the letter of the best answer to each question below.

1. NASA uses radar to track as much space junk as possible, but it's estimated that millions of pieces aren't being detected. Why?

   a. These pieces are too small.

   b. Junk that is made of metal reflects radio waves.

   c. NASA's radar covers only the area of space above North America.

   d. All of the above

2. Which of the following statements is true?

   a. All space debris completely disintegrates when it enters Earth's atmosphere.

   b. NASA is trying to use lasers to nudge debris out into open space.

   c. Space debris as small as a fleck of paint can be dangerous.

   d. Most space debris is created by astronauts who drop tools, bolts, or other objects.

Write your answers on the lines below.

3. Why does space junk eventually reenter Earth's atmosphere?

   _____

4. What causes debris to burn up when it enters Earth's atmosphere?

   _____

5. Why doesn't NASA just blow up old satellites or other space debris?

   _____

6. Why have more satellites been launched in recent years than in the past?

   _____

What's Next?

Skylab and Mir were two space stations that orbited Earth prior to the ISS. Skylab was launched by the United States and was in space from 1973 to 1979. The Russian space station Mir orbited from 1986 to 2001. At the conclusion of both missions, the stations were directed back into Earth's atmosphere, but neither one burned up completely. Do some research to determine where the pieces landed. Did they do any damage?

Ridding the World of Pests

What are the pros and cons of using pesticides on farms?

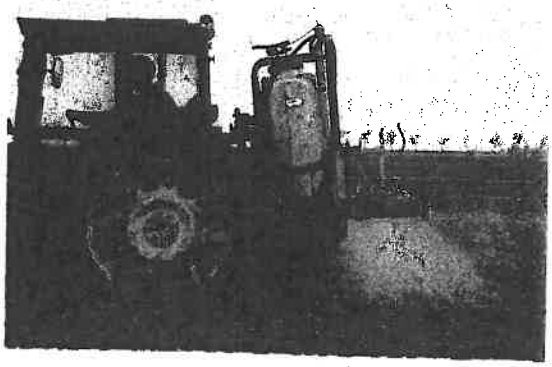
Every year, the use of pesticides in U.S. agriculture prevents the loss of about nine billion dollars. Pesticides are chemicals used to control pests that have the potential to harm crops. The most common types are herbicides (to combat weeds), insecticides (to combat bugs), and fungicides (to combat fungus). Even with the use of a variety of control methods, about one-third of crops are still destroyed by pests.

Farmers, both the owners of small, family farms and the companies that own huge "agri-businesses," are hurt financially by the losses. Consumers are also affected when there is a shortage. Availability of certain items may decrease, and prices are certain to rise. Some people are able to pay the increased prices or have the luxury of choosing other foods. For many, however, food shortages can have serious consequences. Pesticides are an effective method of controlling the pests that damage crops.

Unfortunately, there is a high price to pay for the use of these chemicals. Pesticides are poison, and their effects aren't limited to the weeds and insects they target. One side effect is that **beneficial** populations can also be killed. For example, pesticides that target mosquitoes can also harm other "good" insects that feed on mosquitoes.

In addition, pesticides become a part of the groundwater when residues wash into the soil after it rains. Eventually, they end up polluting all our waterways. Not only can they harm the inhabitants of these waterways, but the effects can also become magnified higher up in the food chain—a concept known as **biological amplification**. The chemicals can affect overall health, as well as the reproduction of the affected animals.

It's probably no surprise, then, that pesticides are harmful to human beings, too. The people who have the greatest exposure—farmers and farm workers who harvest crops—are at the highest risk. They may experience a variety of health problems, including dizziness, vomiting, and respiratory difficulties. Even consumers can be at risk, which is one reason why it's so important to wash produce before you eat it. Most produce, as well as many other foods that use items like corn and soy, contain small amounts of pesticides. Organizations like the Environmental Protection Agency have determined that there is little health risk in consuming such small quantities of the chemicals. There are no guarantees, however, so some people choose to buy **organic** produce, which is grown naturally and pesticide free.



beneficial: useful or helpful

biological amplification: the increase in concentrations of chemicals in organisms at higher levels of a food chain

organic: grown or raised without the use of pesticides, growth hormones, or antibiotics

Farmers, scientists, and consumers are becoming more aware of the hazards of pesticide use, and many are searching for alternative solutions. As a result, Integrated Pest Management (IPM) is becoming more and more widely used in the U.S. In this system, a variety of methods are used to control pests, including chemical, biological (such as the introduction of an insect's natural predators), and physical (such as removing weeds by hand). Controls made from more natural sources are also used. Pest populations are monitored carefully before pesticides are applied to determine whether they're necessary. When chemicals are used, an effort is made to choose ones that pose the least risk.

NAME _____

Write your answers on the lines below.

1. Why is the use of pesticides a complex issue?

2. Who is at the highest risk for exposure to pesticides?

3. What can you do to minimize the amount of pesticides you consume?

4. Give three examples of ways in which the use of pesticides harms the environment.

5. Explain what Integrated Pest Management is and why it's a step in the right direction as far as pesticide use is concerned.

Unifying Concepts and Processes

One problem with the use of pesticides is that over time they can stop being effective in killing insects or weeds. Explain what role natural selection plays in the development of immunity to certain chemicals.

What's Next?

- Do some research to learn about writer/environmentalist Rachel Carson and her book *Silent Spring*. What effect did the book's publication have on the use of a pesticide called DDT?
- The use of pesticides can harm pollinators, like bees and butterflies. What effect does this have on the food supply? Go online or visit a library and learn what role pollinators play in producing the foods you eat every day.

Lesson 6.8 Disaster on the Water

What happens after an oil spill?

After an oil spill, cleanup must begin quickly. Because oil and water don't mix, spilled **crude oil** floats on top of the water, creating an oil slick. As tides come in, the oil spreads over a larger area of water and is carried to land where it clings to the shore. This makes cleanup difficult.

There are several methods of cleaning spilled oil. Over time, it naturally biodegrades, but this is an impractical solution for large spills. Booms, which are like large rubber innertubes, contain the spill area and vacuum the oil. Sorbents—which are made of bales of straw, sawdust, minerals, or synthetic chemicals—act like giant sponges and are used to prevent oil from reaching the shoreline. Small boats called *skimmers* remove oil from the surface of the water, much like a vacuum.

Instead of removing the oil, dispersants chemically break it down into small droplets. They are often used on major oil spills when the oil is too thin to be absorbed or vacuumed. Dispersants, however, create additional problems because they can harm both animal and plant life.

Spilled oil can be burned off, but this causes air pollution. Burning spilled oil can also occur only when the water is calm because high winds may incite the fire.

On the beaches, workers use high-pressure hoses to wash the oil back into the water so that they can absorb or collect it there. Vacuum trucks drive along the beaches to vacuum the oil from the sand.

Hydrocarbons are a risk to marine plants and animals following an oil spill. Birds can be smothered or drowned by the oil. It also causes their feathers to stick together, which makes them unable to fly. Mammals with fur, like sea otters, die from ingesting oil during grooming. It also prevents them from maintaining a sufficient body temperature, which means they can freeze to death. Animals that aren't immediate victims of oil spills are still at risk for developing related problems. Even low doses of hydrocarbons can harm vision, smell, growth, reproduction, and the ability to hunt.

There are many efficient and effective methods for humans to clean up oil spills, but oil-related damage still occurs every year. The best way to decrease the effects of oil spills is to prevent them.

crude oil: oil before it is refined into gasoline and other petroleum products

hydrocarbons: chemical compounds made of only hydrogen and carbon; they form the backbone of crude oil

Human hair naturally absorbs oils. Using scrap hair from beauty salons is a cost-effective way to clean up oil after a spill.

On March 24, 1989, the *Exxon Valdez*, a supertanker carrying 42 million gallons of crude oil, ran into a reef off Alaska's southern coast. The resulting spill of more than 11 million gallons was one of the largest oil spills in U.S. history. About 250,000 marine birds were killed and 151 adult eagles were found dead. If the *Valdez* had a double hull, the spill would have been reduced by 60%. The cleanup cost was $2.1 billion and lasted four summers.

Cleanup crews save animals by using old-fashioned elbow grease. They wash the oil from the animals' eyes and clean their fur or feathers to break down the oil. Once clean, the animals are returned to their environments.

NAME _____

Circle the letter of the best answer to each question below.

1. Which of the following is not a method of cleaning up after an oil spill?

   a. booms

   b. hulls

   c. skimmers

   d. dispersants

2. Which of the following statements is true?

   a. Although cleanup is expensive and time consuming, there are no real long-term effects of an oil spill.

   b. Once animals have contact with large quantities of oil, they cannot be saved.

   c. Oil tankers that have double hulls are likely to spill less oil in an accident.

   d. Burning spilled oil is a safe option only on windy days.

Write your answers on the lines below.

3. What kind of long-term problems can hydrocarbons cause for animals?

   _____

4. The *Exxon Valdez* oil spill had an enormous impact on local birds. How might the changes in bird populations have affected other animals in the ecosystem?

   _____

   _____

5. If crude oil will eventually biodegrade, why are immediate cleanup efforts necessary after a major spill?

   _____

   _____

Unifying Concepts and Processes

Review Lesson 5.2. Then, explain how biotechnology could be used in the cleanup effort after an oil spoil.

_____

_____

A Day that Changed the World

How did the nuclear disaster at Chernobyl happen?

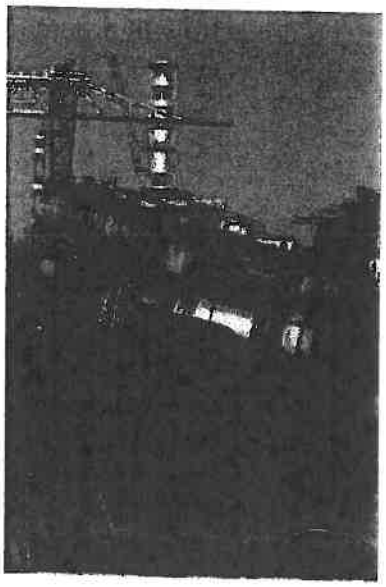
In early morning on April 26, 1986, a test was run on Reactor 4 at the nuclear power plant in Chernobyl, Ukraine—a part of the former USSR. The reactor was running at low power, which made it unstable. Safety precautions that should have been followed by the operators were ignored. As a result, a massive steam explosion took place. It led to a fire in the reactor, causing radiation to be released into the air. The reactor should have been housed in a concrete and steel structure, but it wasn't. Instead, Chernobyl became the worst nuclear power disaster in history.

No one seemed to know immediately how extensive the damage was or how dangerous the conditions were. Firefighters weren't alerted to the danger and didn't wear protective gear. Many of the firefighters and cleanup workers died from exposure to radiation.

In total, about 200,000 nearby residents were evacuated in the weeks after the accident. Radioactive particles were carried on wind currents and traveled across Scandinavia, Europe, and the United Kingdom. The level of radiation in many countries was briefly above normal, but the effects weren't long lasting and no health issues have been tied to it. The Ukraine, Belarus, and Russia were the hardest hit. In particular, the 30-kilometer (18-mile) area that surrounded the nuclear plant became known as the **exclusion zone** and still remains mostly uninhabited today.

Following the accident, something had to be done to quickly stop the additional spreading of radiation. A **sarcophagus** was quickly constructed of concrete to encase the entire reactor. Some of the construction was even done with industrial robots to reduce the amount of human contact. Because it was built so quickly, though, it hasn't held up very well during the last 20 years. It's badly in need of repairs or replacement. Collapse would mean that the remaining radioactive material in the reactor could escape.

It can be hard to see any positive outcomes from such a large-scale tragedy, but there are some. Although some mutations were seen in local animals after the accident, in recent years, animals like moose, wolves, and beavers are returning to the region. The near absence of human beings in the area is creating a sort of unexpected nature preserve.



exclusion zone: the 30-kilometer area surrounding the Chernobyl disaster site; people were originally banned from it, but today, some have returned there to live at their own risk

sarcophagus: the concrete container that prevents radiation leaks from the damaged Chernobyl reactor

More than 100 radioactive elements were released when the reactor exploded. Most had short half-lives and decayed quickly. However, isotopes of strontium-90 and caesium-137 are still found in the area because they have half-lives of 29 and 30 years.

It's difficult to estimate how many people died as a result of the accident because it's hard to know which cases of cancer were caused by the radiation. The best estimates today state that in addition to the 56 people who died immediately following the accident, another 9,000 of the 6.5 million exposed have died or will die as a result of the radiation.

NAME _____

Write **true** or **false** next to each statement below.

1. _____ Within three months of the accident, most residents returned to their homes in the exclusion zone.

2. _____ The effects of the accident were felt around Europe and Scandinavia.

3. _____ Design and operation problems were the cause of the explosion.

Write your answers on the lines below.

4. What was the purpose of constructing the sarcophagus?

_____

5. What problems exist with the sarcophagus today?

_____

6. Why isn't there a good way to determine how many deaths were caused by the accident?

_____

_____

7. Explain what effect the accident has had on the local animal populations. If more humans return to the area one day, do you predict there will be more changes for local wildlife?

_____

_____

Unifying Concepts and Processes

Review the portion of Lesson 1.4 that deals with radiometric dating and half-lives. If caesium-137 has a half-life of 30 years, how long will it take for three-quarters of it to decay? _____

What's Next?

Although there are obviously some serious risks to using nuclear power, there are also many benefits. Do some research online or at the library to find out why nuclear power is often a smart energy choice. Then, form your own opinion—are the benefits worth the risks?

NAME _____

Review

Circle the letter of the best answer to each question below.

1. How much water do you need when you're exercising?
   - **a.** about 32 ounces before and after you exercise
   - **b.** about 8 ounces every 20 minutes
   - **c.** about 8 ounces every hour
   - **d.** about 24 ounces every half hour

2. Which of the following is the FDA not responsible for?
   - **a.** household cleansers
   - **b.** cosmetics
   - **c.** products that emit radiation
   - **d.** pharmaceutical drugs

3. What usually happens to space junk that reenters Earth's atmosphere?
   - **a.** It explodes, breaking into pieces that are too tiny to be problematic.
   - **b.** No one knows for sure.
   - **c.** It is detected by NASA's radar and recaptured.
   - **d.** It burns up.

Write your answers on the lines below.

4. What are two effective ways of dealing with stress?

   _____

5. Give three examples of symptoms that may be stress related.

   _____

6. Are supplements a good source of nutrition for athletes? Explain.

   _____

7. What is the purpose of the FDA?

   _____

8. Why is poverty such a concern for WHO?

   _____

NAME _____

9. How can the material of the clothing you choose to wear affect the environment?

_____

_____

10. Why is space junk a problem?

_____

11. Explain one pro and one con for the use of pesticides in farming.

_____

_____

12. Why do you think Integrated Pest Management is becoming more widely used?

_____

_____

13. How do oil spills affect animals?

_____

_____

Write **true** or **false** next to each statement below.

14. _____ Stress can have both positive and negative effects on your life.

15. _____ Athletes need more protein in their diets than non-athletes do.

16. _____ Eating lots of meats and fatty foods before an athletic event is called *carbo-loading*.

17. _____ Clothing for extremely cold conditions includes layers that have different functions.

18. _____ Tuberculosis was the first disease to be eradicated by WHO.

19. _____ Explosions in space are the greatest source of space junk.