INSTITUTE OF READING DEVELOPMENT

Nonfiction

Program 8

LS version

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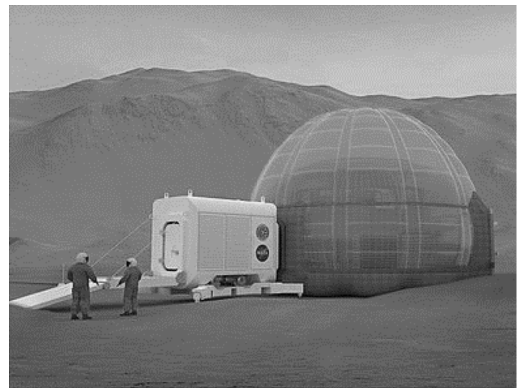
Lesson 1

Making Mars Home

If you've ever imagined yourself on Mars, looking out over a sea of red sand, you're not alone. Humans have created countless books and movies about living on Mars. We're now closer than ever to making that fantasy a reality, but there are some challenges we'd need to overcome.

Living and Breathing

One of the biggest problems with Mars is its extreme environment. The average temperature is a frigid -80°F, and it can get much colder than that. To survive, we'd need to create shelters called "habitats." Engineers at NASA have proposed plastic domes that look like round greenhouses. They would be heated by solar power and sealed to keep that heat in. Outside the habitats, however, space suits would always be necessary.



A simulation of a Martian habitat

Another issue with Mars is that its atmosphere is very thin. That means that the air does not have enough oxygen for humans to survive. In fact, oxygen makes up less than 1% of the atmosphere compared with Earth's 21%. So, we'd have to create oxygen using a machine called the "Mars Oxygen In-Situ Resource Utilization Experiment", or MOXIE, to breathe. It has already been used to turn Mars' carbon dioxide into breathable oxygen.

Eating and Drinking

Getting enough water to survive on Mars would be challenging. What little water the planet has is all frozen. While we could bring *some* water from Earth, it wouldn't be practical or possible to bring enough. This means people would have to mine ice. Just like we dig for gold on Earth, people on Mars would dig for chunks of ice to bring back to their habitats and melt into water.

Anyone wanting to live on Mars would also have to grow their own food. Unfortunately, options would be limited. There'd be no meat, milk, or eggs, since raising animals requires too many resources. Most plants would have a hard time growing, too. Humans would have to rely on things that can live in extreme environments, like cacti, algae, and fungi.

Beyond the Dome: Terraforming Mars

Living in domes, mining for ice and eating algae is only a short-term solution for living on Mars. To truly make Mars home, we'd have to change the entire planet to be more like Earth. This idea, called terraforming, has never been done before. Still, scientists have a plan. Giant mirrors placed in space could direct the sun's warming rays at Mars' polar ice caps, melting them. That would make water available for plants to grow. In time, forests would fill the atmosphere with oxygen. It might take thousands of years, but eventually humans could thrive on Mars.

Martian habitat, NASA/Clouds AO/SEArch, Public domain, via Wikimedia Commons

Lesson 2

A Day in the Kitchen: Then and Now

Imagine stepping back in time to a kitchen in the 1500s. There would be no running water, refrigerator, or even a stove – just a table, a fireplace, and some food. As you can imagine, spending a day there would be very different from what you're used to.

A 16th Century Kitchen in Germany

One of the biggest differences is that there was no electricity five hundred years ago. That means no appliances like blenders and toasters that make working with food easier. For example, while we can warm leftovers in the microwave, in the 16th century they had to build a fire. They had no fridge to keep food fresh, so cooks spent a lot of time drying, smoking, and pickling food to preserve it. No fridge also meant no ice cream!

Keeping your kitchen tidy was also much harder in the 1500s. Today we have easy access to hot, clean water and powerful soap that kills germs. However, people back then didn't even know what germs were! They washed up as best they could until their kitchens "looked" clean. Still, invisible germs were everywhere and often gave people food poisoning.

Pineapple upside-down cake

In the 1500s, people only cooked with foods they could grow locally. Unlike today, they didn't have much access to foods from other parts of the world. For example, Europeans baked cakes with wheat flour and South Americans grew pineapples. But neither could make a pineapple upside-down cake. By contrast, modern kitchens are stocked with ingredients from all around the globe, so making this dessert is no problem.

Comparison

Kitchens Today	Kitchens 500 Years Ago

Lesson 3

The Truth About Pet Cloning

In 2018, the singer Barbara Streisand made headlines by revealing that she had cloned her beloved dog Samantha, who passed away the year before. Since then, thousands of people have followed her lead. But is cloning the right way to deal with the loss of an animal? The truth is that the downsides of pet cloning far outweigh its benefits.

First, pet cloning is really expensive. It costs up to $40,000 to clone a cat and $50,000 for dogs. That's more than many people have saved. But a grieving pet owner could be tempted to do it anyway and end up going bankrupt. Plus, that money could be put to much better use. For the same amount as it costs to clone just one animal, you could help hundreds of homeless dogs and cats.

A dog awaiting adoption at an animal shelter

Dolly, the first mammal to be cloned from an adult cell, lived her entire life at the Roslin

Pet cloning also causes a lot of animal suffering. The cloning process involves live animals, not just test tubes. Cloning companies harvest eggs from donor animals, and they put cloned embryos inside surrogate animals. That's a lot of unnecessary surgeries that cause pain and put animals at risk. What's more, these animals spend their lives being poked and prodded in a lab instead of being loved by a human family.

Finally, pet cloning doesn't actually give you your pet back. While a clone has the original animal's DNA, it doesn't have the same experiences. A cloned puppy won't remember you giving it treats or playing with you in the park. In fact, it might not even *look* like your original dog. That's because animals with identical DNA don't necessarily look the same. In the end, a cloned pet is a new pet, not the animal you loved and lost.

Active Reading in Textbooks

- **Before you read:** Preview the section:
  - Read the section overview & intro paragraph.
  - Figure out how the section is organized.
  - Ask yourself: What am I going to learn about?
- **While you read:** Track main ideas & supporting details.
- **After you read:** Review what you've read.

SECTION 32.4

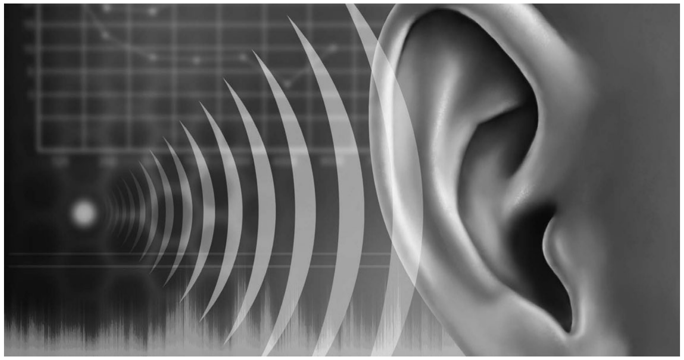
Key Questions

- What are sensory receptors?
- How does the skin sense touch, temperature and pain?
- How do receptors in the eye allow you to see?
- How does the ear control hearing and balance?
- How do receptors in the nose and mouth send messages to the brain about taste and smell?

Vocabulary

- sensory receptors
- mechanoreceptors
- thermoreceptors
- pain receptors
- photoreceptors
- cornea
- pupil
- lens
- retina
- rods and cones
- optic nerve
- tympanum
- cochlea
- semicircular canals

THE Senses



The warm spring sun feels good on your face. Across the street, you see your friend and hear her call your name. A breeze carries the scent of cooking from the nearby barbeque restaurant, and you can almost taste the roasting meat. Your senses – touch, sight, hearing, smell, and taste – are your link to the outside world.

SENSORY RECEPTORS

Specialized cells collect information from your senses and pass it along to your brain. These are called **sensory receptors**. These receptors are located throughout the body, in the skin, eye, ear, nose and mouth. When you feel, see, hear, smell, or taste something, a sensory receptor sends a message to the correct part of your brain to be processed.

SKIN

The skin is the largest sense organ in the body. It has three different types of sensory receptors: mechanoreceptors, thermoreceptors, and pain receptors. They tell your brain when you touch something, when you feel hot or cold, or when something might be a threat to your body.

Touch **Mechanoreceptors** in the skin are responsible for your sense of touch. There are two types of mechanoreceptors in the skin. One is close to the surface and feels light touches, like a breeze blowing across your face. The other is located deeper in the skin and senses stronger pressure, such as a handshake. Mechanoreceptors are not spread out evenly in your skin. For example, the skin on your fingertips is much more sensitive than the skin on your legs, because your fingertips contain many more mechanoreceptors.

Temperature **Thermoreceptors** in your skin feel when you are hot or cold. There are also thermoreceptors inside the body. Your brain uses information from both types of thermoreceptors to try to keep your body temperature at a constant 98.6° F. For example, if thermoreceptors feel that you are cold, your brain may tell your muscles to begin shivering. The movement of shivering creates heat inside the body.

Pain There are two types of **pain receptors** located in the skin and inside the body. These pain receptors protect you from harm. One type of pain receptor sends a message to your brain when something happens that might damage tissues, like excessive heat or cold or heavy pressure. When your brain receives a message from these pain receptors, it will tell your muscles to stop an activity or to move away. The other type of pain receptor releases chemicals to the brain when your body has been damaged, like when you are bruised, cut, or burned. Response to these chemicals explains why cuts and sprains can ache for a long time.

READING CHECK What are the three types of sensory receptors in the skin?

AMAZING ANIMAL SENSES

Did you know that some animals have additional senses that humans don't have? Vampire bats have infrared heat sensors in their noses that send information to the nervous system. These sensors allow the bats to detect the warmth of flowing blood and hone right in on their prey's veins. Many types of snakes, including pitvipers and pythons, have similar sensors. And sharks have a special sensor in their snout that is sensitive to electrical activity, such as the heartbeat of potential prey. A nerve connected to this sensor relays information about the electrical activity to the sharks' brain, which helps them locate their prey.

Figure 12: Each type of sensory receptor responds to different input.

SENSORY RECEPTORS		
TYPE OF SENSOR	RESPONDS TO	WHERE IT'S FOUND
Photoreceptor	Light	Eyes
Mechanoreceptor	Vibrations, movement, touch, pressure	Ears, skin
Thermoreceptor	Heat, cold	Skin, inside the body
Pain Receptor	Tissue damage	Skin, inside the body
Chemoreceptor	chemicals	Mouth, nose, blood vessels

THE EYE

The receptors in the eye are called **photoreceptors**. They convert light into messages that are sent to the brain. As you move around in the world, you depend on sight more than any of your other senses, so it's not surprising that receptors in the eye make up about two-thirds of all the sensory receptors in the body.

Structure of the Eye Before light can be turned into a message for the brain, it has to travel through our eyes. Light first passes through the **cornea**, the clear outer layer that protects the eye. Then, it enters the **pupil**, which is the dark center of the eye. Next, light passes through the **lens**. The lens changes shape based on whether the eye needs to focus on objects that are far away or nearby.

Turning Light into Images After light passes through the lens, it hits the retina. The **retina** is a sheet of cells that contains two types of photoreceptors: rods and cones. **Rods** detect the intensity of light and **cones** detect colors.

Next, the information about light and color is sent to the brain through the optic nerve in each eye. The **optic nerves** are long, thin bundles of tissue that connect each eye to the brain. The brain combines information from both optic nerves to form an image.

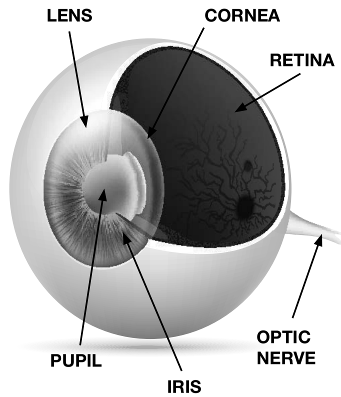


Figure 11: Structure of the Eye

THE EAR

The ear is a sense organ with two functions, hearing and balance. It contains specialized receptors called mechanoreceptors, which convert vibrations and movement into nerve impulses.

Hearing The outer ear collects sound waves, which are vibrations in the air. It funnels the sound waves into the auditory canal where they hit the **tympanum**, or eardrum. Vibrations in the eardrum cause three small bones to vibrate. The movement of these bones sets in motion another membrane. On the interior side of this membrane is a chamber called the **cochlea**. The cochlea is filled with fluid and lined with delicate mechanoreceptors called **hair cells**. The motion of the membrane causes fluid in the cochlea to move. The moving fluid bends the hair cells, triggering a nerve impulse that is sent along the auditory nerve to the brain, where it is interpreted as sound.

Balance The ear also contains three small **semicircular canals** whose function is to help the body maintain its balance and orientation in space. Like the cochlea, the semicircular canals are filled with fluid and lined with hair cells. When you move your head, the fluid in the semicircular canals moves. The moving fluid presses on the hair cells, causing them to bend in various directions, depending on which way your head moves. When a hair cell bends, it creates a nerve impulse that is sent to the brain. In the brain, this information is combined with data from mechanoreceptors in joints and muscles. The brain then signals muscles to make small movements so that balance is maintained.

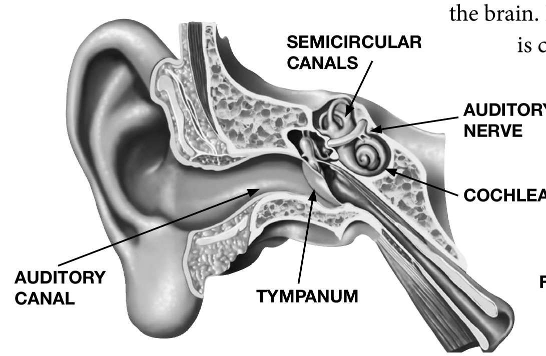


Figure 13: Structure of the Ear

THE MOUTH AND NOSE

Taste and smell are closely related senses that use chemoreceptors in the mouth and nose to send information to the nervous system. Chemoreceptors respond to chemicals, but for these receptors to work, the chemicals must be dissolved in fluid—saliva in the mouth or mucus that lines the nose, for example, or moisture in the air. Have you ever noticed that after a rainstorm you are more aware of earthy odors? This happens because the rain has dissolved chemicals in the ground and tiny water droplets carry them to the chemoreceptors in your nose.

The chemoreceptors in the mouth are located mainly in tiny bumps on the tongue called **taste buds**. These chemoreceptors are stimulated by five sensations—salty, bitter, sweet, sour, and umami, sometimes called savory. Chemoreceptors for each sensation are clustered in a particular part of the tongue. For example, the tip of the tongue is most sensitive to sweet. Taste and smell reinforce each other—think about how if your nose is stuffed up from a cold, your sense of taste is diminished as well.

Lesson 5

Taking Notes in Textbooks

- Write and underline each heading.
- Write down the main idea & supporting details for each paragraph.
- Keep your notes short and easy to read.

The Senses

Sensory Receptors

- Sensory receptors = specialized cells collect info from senses, pass it to brain
  - Located in skin, eye, ear, nose, mouth

Skin

- Skin = largest sense organ
- Has 3 types of sensory recept.

Touch

- Mechanoreceptors = 2 types in skin, resp. for sense of touch
  - 1 type close to surface + feels light touches
  - Other type deeper + senses strong pressure
  - Not spread evenly. Ex: fingertips have more than legs

Temperature

- Thermoreceptors = in skin + body, feel when you're hot/cold
  - Brain uses info from thermorecep. to keep body at constant temp. (98.6° F)

Pain

- Pain receptors = 2 types in skin, protect from harm
  - 1 type tells brain when something happens that might damage tissues
  - Other type releases chemicals to brain when body is damaged

What's wrong with these notes?

Sample 1:

Skin
- Largest sense org.

Touch
- Mechanoreceptors = touch
  - 1 close to surf.
  - Other deeper in skin
  - Fingertips have more

Temperature
- Thermoreceptors = hot/cold
  - Br. uses info for body temp.

Sample 2:

Skin
- The skin is the largest sense organ in the body. It has three different types of sensory receptors: mechanoreceptors, thermoreceptors + pain receptors.

Touch
- Mechanoreceptors in the skin are responsible for your sense of touch.
- There are two types of mechanoreceptors in the skin. One is close to the surface and feels light touches. The other is located deeper in the skin and senses stronger pressure.
- Mechanoreceptors are not spread evenly in your skin. For example, the skin on your fingertips is more sensitive than the skin on your legs because fingertips have more mechanoreceptors.

Temperature
- Thermoreceptors in your skin feel when you are hot or cold. There are also thermoreceptors inside your body.
- Your brain uses information from both types to try to keep your body at a constant temperature of 98.6°F.
- If thermoreceptors feel that you are cold, your brain tells your body to begin shivering. This creates heat inside the body.

Reading Speed Grids

***Where the Red Fern Grows*: **8.5 words per line

# of lines	Reading Speed	# of lines	Reading Speed	# of lines	Reading Speed	# of lines	Reading Speed
1	8.5	16	136	31	264	46	391
2	17	17	145	32	272	47	400
3	26	18	153	33	281	48	408
4	34	19	162	34	289	49	417
5	43	20	170	35	298	50	425
6	51	21	179	36	306	51	434
7	60	22	187	37	315	52	442
8	68	23	196	38	323	53	451
9	77	24	204	39	332	54	459
10	85	25	213	40	340	55	468
11	94	26	221	41	349	56	476
12	102	27	230	42	357	57	485
13	111	28	238	43	366	58	493
14	119	29	247	44	374	59	502
15	128	30	255	45	383	60	510

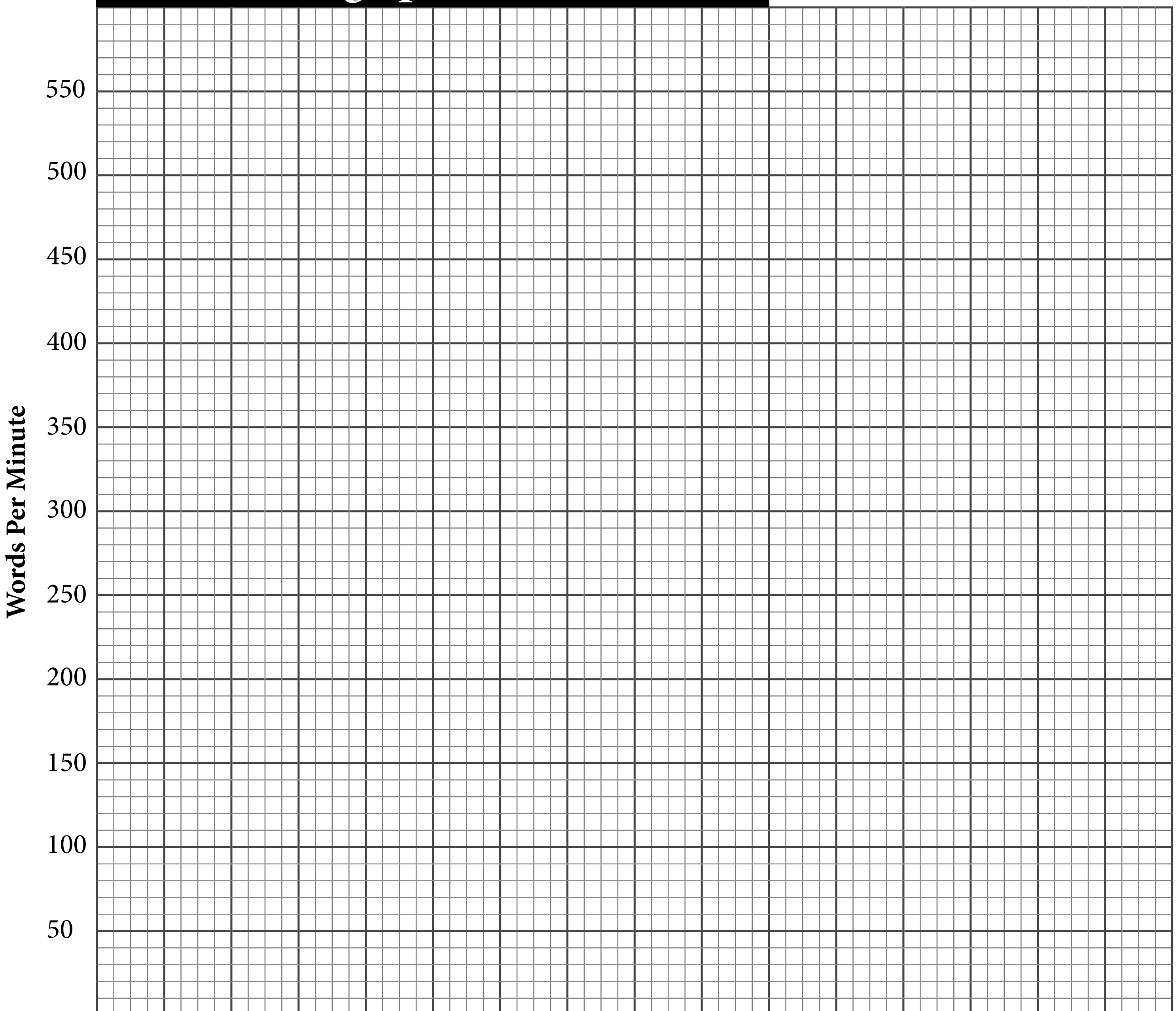
Conducting a Timing in a Non-Class Book

1. First figure out how many words per line your book has. Choose a full line of text (not a short or indented line). Count all the letters, punctuation marks, and spaces in that line, divide by 6, and round to the nearest whole number. That is the average words per line for your book.

2. In your book, mark where you'll begin reading and read for exactly one minute.

3. Count the number of lines you read during the minute. Multiply the number of lines by the number of words per line from Step 1. This is your reading speed. For example, if you read 16 lines in a book that has 11 words per line, your reading speed would be 16 x 11, or 176 words per minute.

Reading Speed Tracker



Speed:

Date:

Title: