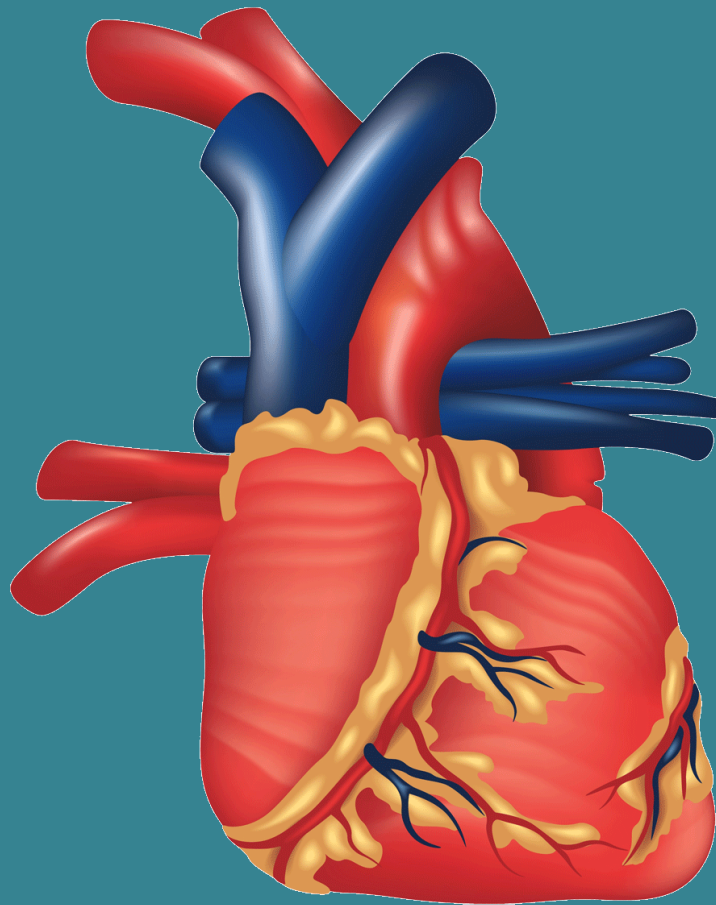


# Academic Core Level B



## Teacher's Guide







# National Institute for Direct Instruction

## Academic Core: A direct approach to teaching fundamental Science and Social Studies concepts

Enclosed is Level B of the Academic Core. This teacher-directed instructional program teaches students important information from four domains—earth sciences, life sciences, physical sciences, and measurement. Each unit's coversheet is color coded to indicate the domain for that unit. They are as follows:

Earth Sciences	Yellow
Life Sciences	Green
Physical Science	Blue
Measurement	Lavender

The program is broken into 11 units. Each unit has 5 to 17 lessons. The lessons are to be presented daily to the whole class and take approximately 20 minutes to teach. The program is sequenced so that information does not overlap and become confusing. Information needed to understand some complex concepts is presented over time in several different units. Units can be used separately as long as students know the basic information taught in earlier units or the earlier units are pre-taught.

If you have questions concerning the program or implementation, contact [info@nifdi.org](mailto:info@nifdi.org).



# Academic Core Level B

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## Overview of NIFDI Academic Core

Academic Core is a highly structured four-level program (A through D) developed by the National Institute for Direct Instruction (NIFDI) to teach students important science facts and information. The program ensures mastery of sophisticated information and includes a built-in rewards system to motivate and reinforce students. Measurement, time, the solar system, rocks, body systems, and United States geography are just a few of the units included in Academic Core Levels A through D.

Academic Core is intended for students in grades 2 and above. Each level is divided into units. Each unit is focused on one specific topic. There are 5 to 17 lessons in each unit in Level B. The lessons take approximately 20 minutes to teach and should be scheduled daily. Each lesson is designed to be presented to the entire class but can also be presented to small groups.

Academic Core is primarily a verbal program directed by the teacher. The teacher presents lessons from a script and students respond verbally. Once brought to verbal mastery, students respond to questions in writing. Many units include reference charts, maps, or displays. This material is on a PowerPoint display contained on a CD. (For teachers who do not have access to the equipment necessary to use the PowerPoint displays, printable PDFs are also available on the CD.) Most units stand alone; however, some units are dependent upon information from earlier ones. This overlap of information requires the teacher to either follow the exact sequence of each level or to make sure the students know the prerequisite information.

### Review

Academic Core does not have a built-in review component; however, the information must be continually reviewed if the students are to remember it. An efficient way to accomplish this is with Review Fridays.

Each Friday, review information is presented. The teacher presents the last two lessons of any unit previously taught. For example, if units 1, 2, 4, and 5 have been taught, the teacher may select any one of these four units to review. The review lessons — the final two lessons in the unit — are marked with the following banner:

---

REGULAR LESSON/MASTERY TEST • FRIDAY REVIEW

---

All students should be at least 90% accurate on Friday Review lessons. If they are not at mastery, the unit or the material missed should be repeated.



## Evaluation

### *Mastery Tests*

The last two lessons of each unit are Mastery Tests. The lessons are a series of questions on the material that was presented during the unit. Students produce written responses to teacher questions and check their work upon completion. Approximate spellings for complex vocabulary or labels are acceptable. At least 90% of students must be at 90% accuracy or above on information before the next unit is started.

## Mastery Over Time

### *Challenge Rounds*

Challenge Rounds are assessments of retention over time. Challenge Rounds are different than the end of unit Mastery Tests. Students take Challenge Round tests from any unit presented up to that point. Challenge Rounds may not include the 15 lessons most recently taught. The challenges ask students to both recall specific information and to use information that they have learned to solve problems. Students who pass the tests earn stickers on a certificate of achievement.

Challenge Rounds are scheduled during the year to provide opportunities to celebrate students' academic achievement in learning difficult information. Challenge Rounds should begin approximately 30 lessons after Academic Core has started and are held the last full week of each month.

### *Challenge Awards*

A student earns a seal on a certificate of achievement every time he/she passes a Challenge Round. Passing five Challenge Rounds earns a certificate. Special recognition such as a medal, letter home, or being honored by the principal should be given after the student earns the second certificate. The number of stickers required for each award level is summarized below.

5 stickers	Certificate
10 stickers (cumulative)	Certificate + Special Recognition (Silver medal, letter home, or award assembly.)
15 stickers (cumulative)	Certificate + Special Recognition (Gold medal, letter home, or award assembly.)



Achievement Excellence Award

Presented to

Gary Davis

For Meeting Challenges of Skill and Knowledge

Challenges:

Length: \_\_\_\_\_

By: Rosella Givens Date: \_\_\_\_\_

### **Pass Criteria for Challenge Rounds**

Each student must perform at 90% accuracy or above to pass a Challenge Round. Any student who fails may retake a Challenge, but must wait at least three full instructional days before retaking it. The passing criterion is still 90%. Students may retake Challenges until they pass.

Examples:

- If Gary fails the Vertebrate Challenge on Monday, the first day he can retake the Vertebrate challenge is Thursday.
- If Maria fails the Temperature Challenge on Thursday, she may not retake it until the following Tuesday.

### **Getting Started**

Academic Core should start with a motivating kickoff event. Tell the students a few interesting facts about the information they will learn during the year. Emphasize that the material is difficult and that even many adults do not know all the things that they are going to learn. Show them the certificate of achievement and describe the silver and gold medals or the special recognition that they will earn. Teach students that the harder they work, the smarter they'll get. Follow this introductory routine for several days.

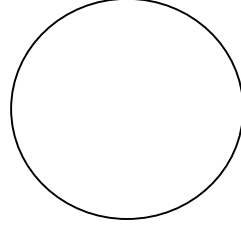
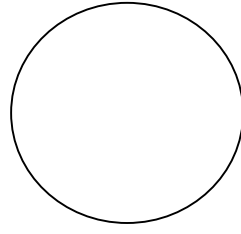
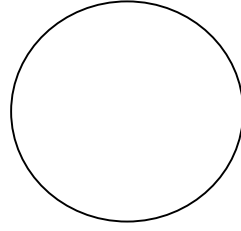
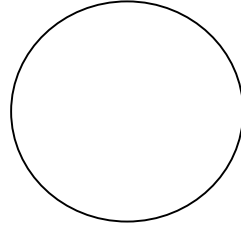
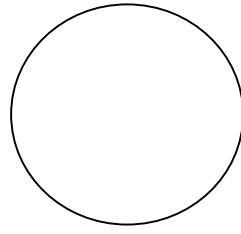


# Achievement Excellence Award

*Presented to*

\_\_\_\_\_  
*For Meeting Challenges of Skill and Knowledge*

*Challenges:*



*By:* \_\_\_\_\_

*Date:* \_\_\_\_\_



# SUMMARY of Information Taught in Level B

## Unit 1. TIME: GEOLOGICAL ERAS AND DINOSAURS

The history of the earth is measured in **geological time**.

The divisions of geological time are called **eras**.

### **Cenozoic**

We live in the Cenozoic era.

It has been going on for 65 million years.

At the beginning, mammals appeared.

### **Mesozoic**

The age of dinosaurs.

It began about 230 million years ago.

Birds first appeared.

### **Paleozoic**

It began about 570 million years ago.

All kinds of sea life appeared: fish, amphibians, early reptiles, trees and land plants.

### **Precambrian**

It began about 5 billion years ago.

First forms of life appeared—bacteria and simple plants.

### **Facts about fossils and rocks:**

The rocks were formed under water by deposits of sand and mud.

The remains of animals were buried under sand and mud. They were like a great pile.

Things **closest to the bottom** of the pile went into the pile **earlier**.

Things **closest to the top** of the pile went into the pile **later**.

Animals that eat meat are **carnivorous**.

Animals that eat plants are **herbivorous**.

Facts about **dinosaurs**:

Some were herbivorous.

Some were carnivorous.

They lived during the Mesozoic Era.

Dinosaurs were reptiles.

They were born on the land.

They were born from eggs.

They were probably cold-blooded.

They came in all shapes and sizes.

Some were the size of chickens. Some were larger than elephants.

Not all of them lived during the same time period.

The Mesozoic Era had 3 periods: **Cretaceous**, **Jurassic** and **Triassic**.

Dinosaurs lived in all 3 periods.

The first true dinosaur was **Plateosaurus**.

It was herbivorous.

It stood on its hind legs.

It was between 16 and 33 feet long.

The largest carnivorous dinosaur was **Allosaurus**.

It stood over 12 feet tall.

The largest dinosaur that ever lived was **Apatosaurus**.

It was herbivorous.

It was 20 feet at the top of the back.

The head was 26 feet above the ground.

Another plant-eater was **Stegosaurus**.

It had plates on its back and a spiked tail.

A large herbivorous dinosaur with 3 large horns on its head was **Triceratops**.

It was 25 feet long.

The largest carnivorous dinosaur of all times was the **Tyrannosaurus**.

It was 50 feet from head to tail.

It stood on its hind legs and was 20 feet tall.

A dinosaur with great armor was **Ankylosaurus**.

It had a hard shell and a club for a tail.

Some of the herbivorous dinosaurs were larger than the largest carnivorous dinosaurs.

Some of the carnivorous dinosaurs were larger than any animal alive today.

## Unit 2. MEASUREMENT OF VOLUME

### Basic/Conversions

**Volume** = those units that refer to the **amount** a container can hold.

There are 2 **cups** in a pint.

There are 2 **pints** in a quart.

There are 4 cups in a **quart**.

There are 4 quarts in a **gallon**.

The **metric unit** which is almost the same size as a quart is a **liter**.

A liter is just a little larger than a quart.

There are 1,000 **milliliters** in a liter.

A milliliter is a **cubic centimeter**.

## Unit 3. PRESSURE

**Pressure** is a **push** or a **press**. The higher the pressure the harder the push. Higher pressure is more pressure.

Facts about **pressure**:

If liquids and gases can move, they will move from places of **high** pressure to places of **low** pressure.

When the pressure is extremely low, there is a **vacuum**. In a perfect vacuum, there is no air at all, so the pressure is extremely low.

If you shake a bottle of fizzy soft drink, you increase the pressure inside the bottle because when you open the bottle, the liquid moves out. When you don't shake the bottle, the liquid does not flow out, so the inside is not a place of high pressure.

Some products are **vacuum packed** – almost all the air is pumped out of the can before it is sealed. The pressure inside the can is very, very low because there's almost no air inside the can.

The inside of a vacuum cleaner is a place of very low pressure. The air goes into the vacuum cleaner. The dirt goes in also because it is just sucked up with the air around it.

An explosion is the opposite of a vacuum. The center is a place of high pressure—things move out from the center.

If there's a hole in the air, there's a vacuum, very low pressure, and air moves into the vacuum.

When lightning goes through the air, it leaves a vacuum behind. Air rushes into that vacuum very fast. The sound it makes when it fills the vacuum is thunder.

If you heat air or liquid that is inside a closed container, the pressure inside gets greater.

## Unit 4. BODY: MUSCLES

The main **purpose** of the **muscles** is to move **bones**.

Facts about **muscles**:

Each muscle has **one job**.

When a muscle works it does one thing: it **gets shorter**. It pulls the bone it is attached to.

Muscles work in pairs. One muscle bends a joint. The other muscle straightens the joint.

When one muscle is **working**, the other one is **relaxing**.

Muscles that cover one bone don't move that bone. They move the bone on the other side of the joint.

### **Deltoid (5)**

shaped like a triangle

joins the upper arm to the shoulder

### **Triceps (3)**

biggest muscle in the upper arm

on the elbow side/bottom

means 3 heads

### **Biceps (2)**

other big muscle in the upper arm

show-off arm muscle/top

means 2 heads

### **Latissimus dorsi (7)**

broadest muscles of the back

attached to the arm

pulls the arms straight overhead to the shoulder

**Abdominals (8)**

cover your belly from the rib cage down to the legs

upper Abdominals—work the most when you lie on your back and sit up.

lower Abdominals—work the most when you lie on your back and lift your legs straight up.

**Trapezius (1)**

fan out from the neck to the shoulders and then down the middle of the back

move the head back and to the sides

work when you shrug your shoulders

**Forearm flexors (10)**

bend a joint

help flex fingers and make a fist

inside of your forearm

**Forearm extensors (11)**

straighten a joint

straighten your fingers out as far as they will go

back of your forearm

**Biceps femoris (12)**

above the knee joint in back

2 headed muscle along the femur

flexor—bends the knee

**Quadriceps femoris (4)**

front of the thigh

means four-headed muscle along the femur

extensor—straightens the knee

**Gastrocnemius (13)**

below the knee joint in the back

works when you stand up on your toes or jump up while your knees are straight.

### **Gluteus (9)**

muscles of the backside

work when you stand up from a sitting position, walk or run

### **Pectoral (6)**

muscles of the chest

attached to the arm

work when you lie on your back with your arms straight out to the sides and bring your arms so they are straight up with the fingers pointing to the ceiling

## **Unit 5. SPEED: UNITS**

Units of **speed** name the **distance** and the **time**.

$$\text{distance per time} = \frac{\text{distance}}{\text{time}}$$

Speed refers to distance per time.

Another word for speed is **rate**.

A speed of 30 miles per hour is the rate of 30 miles per hour.

The **slowest rate unit** has the **smallest distance** unit and the **greatest time** unit.

The **fastest rate unit** has the **largest distance** unit and the **smallest time** unit.

## Unit 6. MEASUREMENT OF VOLUME: CALCULATIONS

Basic/calculations

A **line** has one dimension—**length**.

A **square** has two dimensions—**length** and **width**.

$$x^2 = x \text{ squared} = x \text{ times } x$$

**Area** of a square = **square** the number for the **side**.

The area of a square is written, sq. in., sq. ft., sq. cm., etc.

A **cube** has three dimensions—**length**, **width**, and **depth**.

$$x^3 = x \text{ cubed} = x \text{ times } x \text{ times } x.$$

**Volume** of a cube = **cube** the length of the **side**.

Volume of a cube is written, cu. in., cu. ft., cu. cm., etc.

Square—if you double the length of a side, you increase the area 4 times.

Cube—if you double the length of an edge, you increase the volume 8 times.

## Unit 7. SPEED: FACTS

Facts about **speed**:

A person who walks fast goes about 4 miles per hour.

A person who runs fast goes about 12 miles per hour.

The fastest runners in the world can go over 24 miles per hour.

A fast bicyclist can go 30 miles per hour.

A fast dog can run about 35 miles per hour.

A fast horse can run about 40 miles per hour.

A cheetah can run over 60 miles per hour.

Sound travels at 740 miles per hour.

Light travels at 186,000 miles per **second**.

**Lightning** and **thunder** happen together, at the same time.

The lightning makes the thunder.

If you are some distance from the lightning, you will see it before you hear the thunder.

You can count the seconds from the time you **see** the lightning to figure out how far away the lightning is.

If you count five seconds and then hear the thunder, the lightning was one mile away.

If you hear the thunder before you count five seconds, the lightning was less than a mile away.

If you hear the thunder after you count five seconds, the lightning was more than a mile away.

More facts about **speed**:

The speed limit in the business districts of most cities or towns is 30 miles per hour or less.

The speed limit on freeways or interstate highways is 65 miles per hour.

The speed limit on regular highways is 55 miles per hour.

The speed limit near schools is 20 miles per hour.

A race car goes over 200 miles per hour.

A regular jet plane goes over 500 miles per hour.

Some jet planes go over three times the speed of sound. That's over 2,200 miles per hour.

## Unit 8. DENSITY: FLOATING, SINKING

If two things are the **same size**, but **NOT** the **same weight**, the thing that **weighs more** is **more dense** than the other thing.

Facts:

Water is more dense than air.

Iron is more dense than water.

Rock is more dense than water.

How to test whether something is more dense than water:

If it **sinks** in water, it is **more dense** than water.

If it **floats in water**, it is **less dense** than water.

How to show that air is less dense than water:

Put one end of a straw under water and blow air through the straw.

The **bubbles** of air **float**, so the air is **less dense** than the water.

More facts:

Helium gas is less dense than water.

Helium gas is less dense than air.

Oil is less dense than water.

Gasoline is less dense than water.

Mercury is more dense than water. It is more dense than rock. It is more dense than iron or steel.

Salt water is more dense than fresh water.

A person can float in salt water more easily than in fresh water.

When objects float in different liquids, you can figure out which liquid is more dense.

The more dense the liquid is, the smaller the amount that is displaced.

Facts about **density**:

If things are the **same weight**, the **more dense** substance is the one that is **smaller**. It takes up less space because it is more dense.

If something **sinks** in a liquid, it **displaces** some liquid. It moves the liquid out of the way.

The **amount** of liquid an object **displaces** is the **same size** as the object that sinks.

If you drop a stone in a can of water, the level of the water will go up a little bit. The amount the water goes up is the amount that is displaced. That amount is exactly the same size as the stone.

If an object **floats** in water, it will displace some liquid. But that liquid will **not** be the size of the floating object, because not all of the object is moving water out of the way. The amount of the water that is displaced is the size of the object that is **under water**.

A **larger piece** of a substance and **smaller piece** of the same substance have the **same density**.

#### Facts about **sound**:

We normally hear sound that travels through the air.

Sound travels through water, steel, and through other liquids and gases.

Sound goes faster when the temperature is higher.

Sound goes faster when the medium is more dense.

If there is no medium to carry the sound, there is no sound. In outer space, there is no sound because there is no air.

The air gets less dense as you go higher and higher in the mountains or higher in a plane.

## Unit 9. BODY: CIRCULATORY SYSTEM

The **circulatory system** circulates blood throughout the body.

The circulatory system consists of the **heart**, the **lungs**, **blood vessels** and **blood**.

Blood vessels are tubes that carry blood.

There are two types of blood vessels.

Blood vessels that carry blood from the heart are called **arteries**.

Blood vessels that carry blood back to the heart are called **veins**.

Every time the heart beats, all arteries pulse.

Veins do not pulse.

**Blood** changes **color** from bright red to very dark, almost black. When it is **bright red**, it is full of **oxygen**. When it is **dark**, it has **no oxygen** in it.

All the veins but one carry dark blood.

All arteries but one carry red blood.

The circulatory system is designed to carry blood with oxygen to the body, to drop off the oxygen because the cells in the body need oxygen to work, and then to return the blood to the lungs where it can pick up oxygen again. On this round trip the blood

passes through the heart two times, one time when it carries red blood out to the body and the next time when it pumps the blood with no oxygen to the lungs.

The route the blood takes when it goes through the body:

Red blood goes out from the heart through arteries.

The blood goes into tiny blood vessels called capillaries.

The blood gives up its oxygen. The body needs this oxygen for the muscles to do work. No oxygen, no work.

As soon as the blood gives up the oxygen, it turns dark.

It starts back to the heart through the veins.

When the blood reaches the heart, it is pumped out through **an artery that takes it to the lungs.**

At the lungs, the blood picks up oxygen, which turns the blood red.

Then the red blood returns to the heart through a vein.

Facts about the **heart**:

The heart is divided into a left side and a right side.

The **left** side of the heart is the red side. It collects red blood from the lungs, and it pumps out red blood to the body.

The **right** side of the heart is the **blue** side. It collects dark blood from the body and pumps out dark blood to the lungs.

The heart has **four chambers**, two on each side. The top chambers of the heart collect blood. These chambers are called **atria**.

There's a left atrium for red blood and a right atrium for blue blood.

When the heart beats, blood goes from the atria to the bottom chamber on each side.

The bottom chambers are called **ventricles**. They pump blood from the heart. The left ventricle pumps red blood from the heart. The right ventricle pumps dark blood from the heart.

The **main artery** that leads from the heart and goes to the body is called the **aorta**. It's the largest artery in the body.

The **main veins** that come from the body are the **vena cava**.

The arteries and veins that go to and from the lungs are called **pulmonary**. That means lungs.

There's a pulmonary artery that goes from the heart to the lungs.  
The pulmonary artery carries the dark blood to the lungs.  
There are two pulmonary veins that go from the lungs back to the heart.

The material in the blood that turns the blood red when it comes in contact with oxygen is called **hemoglobin**.  
The cells that contain hemoglobin are called **red blood cells**.  
The other main cells are **white blood cells**. They fight infections.

## Unit 10. BODY: NERVOUS SYSTEM

The **nervous system** is made up of the **brain**, the **spinal cord**, and the **nerves** that go to and from the different parts of the body including the eyes, the ears, the nose and the mouth.

The nerves are like slippery wires.  
They carry electrical impulses, like tiny sparks.  
Those nerve impulses move at the rate of about 185 miles an hour.

**Nerve impulses** can reach most parts of your body in about 1/100th of a second.  
The taller a person is, the longer it takes the nerve impulses to go to and from the different parts of the body.

There are two different kinds of nerves.  
Nerves that go from the brain to different parts of the body are called **motor nerves**. They are like motors that run your body.  
The nerves that bring messages to the brain from other parts of the body are called **sensory nerves**. They let you feel things.

The **control center** for the nervous system is the **brain**.  
There are three main parts to the brain: cerebrum, cerebellum, and the brain stem.

## Cerebrum

The part that is on top and has all folds and wrinkles.

The largest part of the brain.

The part that lets you think.

The part that has to do with **voluntary** actions.

## Cerebellum

The main job is to maintain your balance.

You are not consciously aware that this part senses muscles contracting and expanding.

## Brain Stem

Is at the base of the brain.

Connects the other parts of the brain to the spinal column.

Controls the machinery of the body—the heart, breathing, digestion, and also the hormones or chemicals that control growth, how much body fat you have, your body hair, and a lot of other features of the body that change as you get older.

You are not consciously aware of what this part is doing.

## Facts about the **brain**:

For most things, the left side of the brain is connected to nerves on the right side of the body. The right side of the brain is connected to nerves on the left side of the body.

The centers for directing different parts of the body are in the cerebrum.

The two sides of the cerebrum are called **hemispheres**.

The cerebrum has lobes that do different things. There are **four lobes** in each hemisphere.

The front part of the hemisphere is the **frontal lobe**. The frontal lobe helps you do long-range planning.

Behind the frontal lobe is the **parietal lobe**. It coordinates your reactions to all the sensations on one side of the body. The left parietal lobe helps you coordinate how you react to feelings of cold, pressure, pain, and other feelings on the right side of the body.

Below the parietal lobe is the **temporal lobe**. It helps you understand speech. This is where your memory for much of what you learn is.

The back part of the hemisphere is the **occipital lobe**. This is where you receive messages for your eyes—the visual center.

The dividing part between the two hemispheres of the brain is called the **corpus callosum**.

The nerves that run to and from the brain go in thick bundles through the vertebrae in the spine. The vertebrae are hollow and the nerves go through the hollow part. This part of the nervous system is called the **spinal cord**.

Nerves branch from the spinal cord to different parts of the body.

At the ending of sensory nerves are **receptors**.

Each receptor can sense only one thing.

Some nerves do not have receptors.

The bare nerve endings sense pain.

The motor nerves go into muscles.

They end up attached to muscle fibers.

In each muscle there are hundreds of thousands of motor nerves. In your biceps, there are hundreds of thousands of motor nerves.

When an electrical impulse goes through the main nerve, the impulse causes the muscle fiber to contract.

## Unit 11. WATER CYCLES

Facts about **water**:

All living things need water.

There is only so much water in the world.

Water goes around and around, from the oceans, to the clouds, to the ground, to us, and then back to the ocean. That's called the **water cycle**.

Three main things happen in the water cycle: evaporation, condensation, and precipitation.

**Evaporation** means that water leaves the surface of water and goes into the air. The parts that go into the air are so small that you couldn't see them with a magnifying glass. These small parts are called **water molecules**.

**Condensation** means that water molecules that are in the air form tiny drops of water made up of thousands of water molecules.

Clouds, fog, or dew are made up of tiny drops that have condensed from the air.

**Precipitation** is rain, snow, hail, or sleet. Precipitation takes place when the tiny drops in clouds form bigger and bigger drops of water. When they get too big to keep floating in the air, they fall as rain, snow, hail, or sleet.

Facts about **evaporation**:

Water evaporates faster on a hot day than on a cold day.

Water evaporates faster when the air is drier and/or hotter.

Most evaporation takes place over the oceans.

As air changes temperature and gets hotter, it can hold more water. It may pick up water until it can't hold all the water molecules it has. That's when condensation occurs.

What happens with water:

It starts out in the oceans.

Water will evaporate from the surface until the air can't hold any more water molecules. Then the air is pretty wet.

Water condenses from the air to form lots of clouds. This condensation keeps going on until there are so many water droplets in clouds that they start banging into each other and forming larger and larger drops.

Precipitation takes place. The clouds empty, and rain or snow falls. Some falls on the land. We use some of it. Most of it ends up in rivers that go back to the ocean. The water cycle starts all over with more evaporation.

Air that is wet is **humid**.

Facts about **relative humidity**:

The amount of water or moisture in the air is called relative humidity.

If air is holding all the water it can hold, the relative humidity is as high as it can get. That's 100 percent.

When the relative humidity is 100 percent, it's raining or snowing, because some moisture in the air is coming out as precipitation.

Zero percent humidity means that there are no water molecules in the air. When air cools, the relative humidity goes up.

When air gets hotter, the relative humidity goes down.





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