

Academic Core Level C



Teacher's Guide





National Institute for Direct Instruction

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

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

Earth Sciences	Yellow
Life Sciences	Green
Measurement	Lavender

The program is broken into 8 units. Each unit has 4 to 19 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.

Academic Core Level C

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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 4 to 19 lessons in each unit in Level C. 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 Power Point 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.)



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

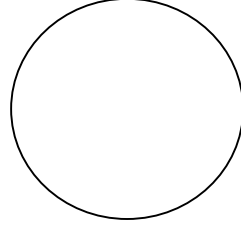
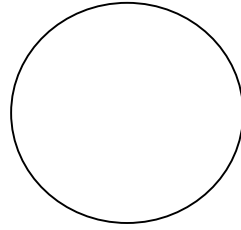
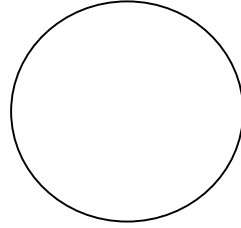
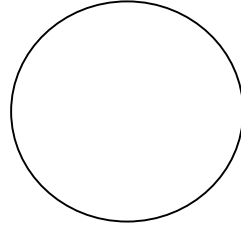
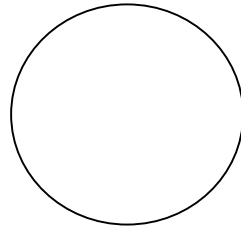
Academic Core should start with a motivating kickoff event. Tell the students a few interesting facts about the information they will learn during the year. Emphasize that the material is difficult and that even many adults do not know all the things that they are going to learn. Show them the certificate 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 C

Unit 1. ROCKS: IGNEOUS, SEDIMENTARY, METAMORPHIC

The Earth has four parts: the crust, the mantle, the outer core, and the inner core.

Facts about the **Earth**:

The inside is very hot. The temperature near the center of the earth is 10,800 degrees Fahrenheit.

The **crust** is the outside. That part is cool. It's cold rock in the solid phase. Below the crust is the part that is very hot, but it can move around. This is called the **mantle**. It is also made of solid rock, but the rock is very hot. When there are volcanoes, the lava that comes out of the volcano comes from the mantle.

Closer to the center of the Earth is the **outer core** which is made of **liquid** iron and nickel and **the inner core** which is made of **solid** iron and nickel.

There are three main kinds of rocks: igneous, sedimentary, and metamorphic.

Igneous are the original rocks that formed the crust of the Earth billions of years ago when the Earth was formed. Right now, igneous rocks are in the mantle.

The two main types of igneous rocks are **granite** and **basalt**.

Granite is the rock of mountains that are not volcanoes. That rock cools slowly.

Basalt is the rock of volcanoes. It comes out and cools fast.

Sedimentary is nothing but small pieces of rock that are cemented together.

Sedimentary rock is formed at the bottom of oceans or lakes.

The ocean waves on a beach break rocks down and turn them into sand.

The animals that have shells live in the sea. When they die, their shells sink to the floor of the ocean. In time, layers of sedimentary rock form.

The three main types of sedimentary rock are **sandstone**, **limestone**, and **shale**.

Sandstone is just sand cemented together.

Limestone is the shells of animals that are cemented together.

Shale is just mud that is cemented together.

Metamorphic is rock that is under so much pressure or is heated so much that it turns into a new kind of rock.

Unit 2. BODY: DIGESTION

The **digestive system** changes food into material the body needs to work and grow. The digestive system consists of the **mouth**, the **esophagus**, the **stomach**, the **liver**, and the **small and large intestines**.

Digestion starts in the **mouth**.

The **teeth** break food into smaller pieces.

Saliva wets the food.

The food from the mouth passes through the **esophagus** to the **stomach**.

Food stays in the stomach about four hours.

The stomach produces acid.

The acid changes the food into simpler chemicals.

When food leaves the stomach it goes into the **small intestine**.

Liver bile from the liver breaks down the food into smaller chemicals.

This broken down food passes through the walls of the intestine into the blood stream. This process takes about five hours.

The small intestine is about 20 feet long.

Undigested food goes into the **large intestine**.

Water is removed from the undigested food.

Undigested food stays in the large intestine from seven to 16 hours.

What is left is solid and liquid waste. Solid waste goes into the **rectum**.

It stays here up to 14 hours.

This solid waste called **feces** comes out through the **anus**.

Liquid waste is eliminated through the **kidneys**, the **bladder**, and the **urethra**.

The liver produces **urea**.

The kidneys filter water and urea from the blood.

This is **urine**.

Urine is stored in the bladder until it is full.

Urine leaves the bladder through the urethra.

The body also gets rid of water through sweating and breathing.

Unit 3. BODY: TEETH

Facts about **teeth**:

Teeth are bones.

Adults have 32 teeth. Children younger than six have 20 teeth.

The flat teeth in back are **molars**.

Molars are thick teeth with tops that are flat.

Molars grind food.

Adults have 12 molars. Children have eight molars.

The teeth in front of the molars are **canine** teeth.

You have four canine teeth.

Canine teeth are pointed like dog's teeth, and they are designed to tear through flesh.

The teeth in front are **incisors**.

They are thin like knife blades.

Incisors cut through food.

You have eight incisors.

Your first set of teeth are not **permanent**. You lose all of your first set and they are replaced by permanent teeth.

A little baby with no teeth showing has the start of teeth—20 baby teeth and 32 adult teeth.

The teeth that you get after age 10 are **bicuspid**s and molars.

The bicuspid are between the canines and the molars.

Children get eight bicuspid.

Some animals are carnivorous and some are herbivorous.

Carnivorous animals **eat meat**.

Cheetahs, lions, tigers and other cats are carnivorous.

Animals that **eat plants** are **herbivorous**.

Sheep, cows, horses, goats and other similar animals are herbivorous.

If an animal has no pointed teeth, the animal does not eat meat, so they are herbivorous.

Animals with pointed teeth, like canine teeth, eat meat and are carnivorous.

Unit 4. TEMPERATURE CONVERSIONS: FAHRENHEIT/CELSIUS

The unit we use to measure temperature is **degrees**.

The name of the scale we normally use to measure temperature is **Fahrenheit**.

The name of the scale most of the world uses to measure temperature is **Celsius**.

You can convert **Fahrenheit temperatures** into **Celsius temperatures**.

First subtract 32 degrees from the Fahrenheit temperature.

Then multiply the answer by 5/9.

Celsius degrees are **larger** than the Fahrenheit degrees.

They are almost twice as big.

When you multiply by 5/9 you end up with a lot fewer degrees.

You write 40 degrees Celsius: **40° C**.

You write 40 degrees Fahrenheit: **40° F**.

Sample problem:

Change 77 degrees Fahrenheit into Celsius.

The first thing we have to do is **subtract 32**.

$$\begin{array}{r} 77 \\ - 32 \\ \hline 45 \end{array}$$

Now we **multiply** 45 by $\frac{5}{9}$

$$\frac{45}{1} \times \frac{5}{9} = 225 \div 9 = 25^{\circ} \text{ C}$$

So, 77 degrees Fahrenheit is 25 degrees Celsius.

You can convert **Celsius** temperatures into **Fahrenheit** temperatures.

You **multiply** Celsius by $\frac{9}{5}$ to find Fahrenheit temperatures.

First **multiply** by $\frac{9}{5}$. Then **add** 32.

You multiply by more than 1 because you need more smaller units.

Sample problem:

What's the Fahrenheit temperature for 60 degrees Celsius?

$$\frac{60}{1} \times \frac{9}{5} = 540 \div 5 = 108 \quad \begin{array}{r} 108 \\ + 32 \\ \hline 140^\circ \text{ F} \end{array}$$

You multiply 60 by $\frac{9}{5}$. The answer is 108. Then you add 32.

That's 140.

So 60 degrees Celsius is 140 degrees Fahrenheit.

Review:

To change Fahrenheit to Celsius, you're going to larger units, so there are fewer units. You subtract 32, and then multiply by $5/9$.

To change Celsius to Fahrenheit, you're going to smaller units, so there are more of them. You multiply by $9/5$, and then add 32.

Facts about temperature:

The **boiling** temperature of water on the Fahrenheit scale is 212° F, and on the Celsius scale it's 100° C.

The **freezing** temperature of water on the Fahrenheit scale is 32° F, and on the Celsius scale it's 0° C.

The normal body temperature of humans on the Fahrenheit scale is 98.6° F, and on the Celsius scale it's 37° C.

The melting temperature of glass on the Fahrenheit scale is 2,500° F.

Unit 5. SENSES: HEARING AND SOUND

We know about the world through our senses.

Our senses tell us where things are, what they look like, and what kind of features they have.

We have five main **senses: hearing, sight or vision, smell, taste, and touch.**

For each of the five senses you have **sense organs.**

Hearing – ears

Vision – eyes

Smell – nose

Taste – tongue

Touch – sensors all over the body

Some things that you hear have a higher pitch than other things.

Facts about **sound:**

Sound is created by vibrations.

The higher the note, the faster the vibrations.

A low *do* vibrates much more slowly than a higher *do*.

A high *do* always vibrates twice as fast as the next lower *do*.

Facts about the do-re-mi **scale:**

The scale has eight notes.

The difference in sound between the low *do* and the next higher *do* is called an **octave.**

The word octave means **eight** divisions.

Every time you move up an octave, you double the rate that the air is vibrating.

Facts about **hearing**:

We can hear sounds from about 20 vibrations per second to about 20,000 vibrations per second. That's about 10 octaves.

Most animals can hear things that are too high pitched for humans to hear.

Dogs can hear sounds that are 50,000 vibrations per second.

Cats can hear sounds that are 60,000 vibrations per second.

Bats can hear sounds that are 120,000 vibrations per second.

Dolphins can hear sounds that are 150,000 vibrations per second.

How the **ear** works:

The **outer ear** is like a funnel that collects the sound. The sound is vibrations that the air makes. Those sounds press against the **eardrum**. Behind the eardrum is the middle ear. When the eardrum moves, it makes three tiny bones move in the middle ear. Those bones are the smallest bones in your body. They are called the **hammer**, the **anvil**, and the **stirrup**.

The hammer is closest to the eardrum; the stirrup is farthest from the eardrum.

These three bones magnify the vibrations and send them to the inner ear.

The **inner ear** is filled with fluid. The sound moves this fluid. There's a spiral chamber in the inner ear called the **cochlea**. The cochlea has tiny hairs in it. Those hairs are the sensors that vibrate with the sound.

When **low sounds** are received by the ear, the only hairs that vibrate are far **inside** the cochlea. When **higher** sounds are received by the ear, the only hairs that vibrate are closer to the **outside** of the cochlea. Sounds that are **louder** make hairs vibrate **harder**.

Note: Particular hairs vibrate only for particular rates of vibration. Each hair has a nerve attached to it. When the hair vibrates, the nerve sends a message to the brain, and that's what you hear—the vibration of hairs.

The outside of the ear is like a funnel that picks up sound. The human ear is not as good a funnel as the ears of other animals.

Dogs and cats that have ears that stick up are good sound collectors. You can improve your ear's hearing by holding your hand behind it and making a cup shape. You can hear things better. They sound louder.

Vibrations cause sound.

A larger mass will vibrate slower than a smaller mass.

If you strike a big plate and a small plate, they will make a sound.

The big plate will vibrate slower, so the big plate will make a sound that has a **lower pitch** than the small plate.

If you hit two drums, one that is big and one that is small, the big drum will make the slower vibration and a lower-pitched sound.

If you put a ruler so that part of it extends over the edge of a desk, you can make sounds by bending the free end down and letting it go. The longer the part of the ruler that is not touching the desk, the slower the vibrations.

If you have two glasses, one with more water than the other, the glass with more water in it will have a lower pitch than the other.

Unit 6. SENSES: VISION

The organ which gives us the **sense of sight** is our **eyes**.

Our eyes are like cameras.

Facts about **light**:

White light is made up of all the different colors of light that are in the rainbow.

You can remember the colors by remembering the name **Roy G Biv**: **red, orange, yellow, green, blue, indigo, and violet**

Each color of light is a **wave**.

The wave for red light is longer than the wave for any of the other colors. **Red** has the **longest** waves, **violet** has the **shortest** waves.

White light is made up of light of all seven colors.

You can prove that by splitting white light into a rainbow. When you put a prism-shaped glass in sunlight, it will make a rainbow. All those colors came from white light.

Another name for the **rainbow** is the **visible spectrum**.

Glass and other transparent objects **bend light**. The denser the glass or transparent substance, the more the light is bent.

If light comes in at a right angle to the surface, **light does not bend**.

The farther the incoming light is from a right angle, the more it bends.

The light always bends so that the angle on the inside of the glass is closer to a right angle.

Objects that are designed to bend light to make images are called **lenses**.

Glasses have lenses.

Those lenses permit people to see better by bending the light in particular ways.

Cameras have lenses.

Those lenses make images of the things you want to photograph.

The camera has a lens that bends the light.

The eye also has a lens that bends the light.

The camera has an **iris** that can open wide and let more light pass through the lens or can close down and let just a little bit of light go through the center of the lens.

The eye has an iris that does the same thing. The iris is the part of the eye that is **colored**.

The black dot in the middle of the eye is the hole the iris leaves.

At the back of the camera is film. Any pattern of light that reaches the film leaves an image.

The back of the eye has a **retina**. The retina is covered with sensors that pick up the pictures the eye captures.

The retina has hundreds of tiny sensors. Some sensors pick up colors; some sensors pick up images when it is pretty dark out. The daylight sensors are called **cones**. The night vision sensors are called **rods**.

The hole in the middle of the eye is called the **pupil**.

When the pupil is large, the hole is large. That's what happens in dimmer light. When there's a lot of light, the pupil gets smaller.

The night vision of humans is not as good as it is in some other animals. Dogs and cats and many other mammals see better than humans at night.

Unit 7. SENSES: TASTE AND SMELL

The organ that gives you information about how things **smell** is the **nose**.

The organ that gives you information about how things **taste** is the **tongue**.

Facts about taste and smell:

Taste and smell work together.

A lot of the taste that you experience when you eat is caused by the smell.

You have **sensors** for many, many different kinds of smells, but you only have a few sensors for taste.

The tongue is covered with the sensors for taste. These sensors are called **taste buds**.

Different taste buds pick up different tastes.

There are five different kinds of flavors you can taste: **sweet**, **salty**, **sour**, **bitter**, and **savory**.

Unit 8. GEOGRAPHY: CONTINENTS AND OCEANS

Continents are large areas of land.

There are six continents:

- North America** – where we live
United States, Canada, Mexico, and some smaller countries
- South America** – large land mass that is south of North America
- Antarctica** – south pole and is the coldest
- Australia** – the smallest of all the continents
on the other side of the world from us
- Eurasia** – the biggest continent
made up of many countries
sometimes referred to as two continents: Europe and Asia
- Africa** – a large continent that almost touches part of Eurasia

Oceans are very large bodies of water that contain salt water, not fresh water.

There are five oceans:

The **Atlantic Ocean** is on the east boundary of North America.

The **Pacific Ocean** is on the west boundary of North America and is the largest ocean.

The **Indian Ocean** is below India and goes from Africa to Australia.

The **Southern Ocean** is around the southern part of South America and surrounds the South Pole.

The **Arctic Ocean** surrounds the North Pole.

3/4 of the surface of the earth is covered with oceans.

All oceans have **salt water**. You can **float** more easily in an ocean than you can in fresh water.



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