SCIENCE
THE SEARCH

Discovering the Principles
that Govern God's Creation

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BOOK 2 INTERACTION & SYSTEMS

THE CORNERSTONE CURRICULUM PROJECT

OBSERVATION NOTEBOOK

What's the Difference?

9/9/94 Activity 1

Object	Before	After
Ice		
Water		
Sugar		

Interaction

9/16/94 Activity 2

Interaction

Object	Before	After

ACTIVITY 1
WHAT'S THE DIFFERENCE?

MATERIALS
ice cubes
glass
3 jars, disposable
sugar
any breakfast: bacon and eggs, pancakes/waffles, cold or hot cereal

OVERVIEW
EXPLORING THE CONCEPT: INTERACTION & EVIDENCE OF INTERACTION

LESSON PLAN

WHAT I AM TO DO	WHAT I AM TO SAY
1. Give your children the ice cube and glass.	
Make this chart in the OBSERVATION NOTEBOOK	

OBJECT	BEFORE	AFTER
Ice		

	"Describe as many of the properties of the ice cube as you can and I will write your observations in the 'BEFORE' column."
	"Observe what happens to the ice cube."
After the ice cube has melted…	
	"What has happened to the ice cube?"
	"Describe the properties of the melted ice cube and write your observations in the 'AFTER' column."
	"Compare the properties before and after melting….how are they alike? … Different?"
	"What properties stayed the same?"
	"What properties changed?"

2. Give your children a glass of water and a teaspoon of sugar.

"Now write the properties of the water in the 'BEFORE' column."

Object	*Before*	*After*
Ice		
Water		
Sugar		

"Describe the properties of the sugar. List them in the column titled 'BEFORE'."

"Compare the properties of the water with the sugar."

"How are they alike?… Different?"

"Put the sugar into the water."

"Describe the properties of the sugar and water now… Write these properties in the 'after' column."

"How has the sugar changed?"

"How has the water changed?"

"Which properties changed?"

"Which remained the same?"

"What do you think would happen if we let the sugar water set in the window for a week or more?"

"Let's set it over here and watch what happens."

Let the sugar water set until all the water evaporates.

"What happened to the water? What about the sugar?"

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3. This section should be taught as you are preparing breakfast on several mornings. I will supply the dialogue for the bacon and egg breakfast….adapt the conversation to fit the other kinds of breakfasts.

"Describe the properties of the uncooked bacon and eggs. Write these properties in the column titled 'BEFORE'."

Then fry the eggs slowly, so that your children can observe the effects of the heat.

"The major property of the stove at this time is that it is hot."

"What is happening to the bacon and eggs?"

After they have cooked…

"Describe the properties of the bacon and eggs now. Write these in the 'AFTER' column of your notebook."

"How have the bacon and eggs changed? What do you think caused the change?"

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4. During the next several weeks have your children look for objects that change. Ask them to tell you what it was like before the change and what it was like after the change.

"Keep a record of your observations."

ACTIVITY 2
INTERACTION

MATERIALS
2 balls

OVERVIEW
NAMING THE CONCEPT: INTERACTION

LESSON PLAN

WHAT I AM TO DO	WHAT I AM TO SAY
1. Have your children look at their 'BEFORE and AFTER' chart from ACTIVITY 1.	"Tell me what we observed in the last activity?"
2. Role one ball into another.	"What happened to the balls?" "One object can change another object. Heat changed the ice cube… Sugar changed the water… Water changed the sugar… Heat changed the bacon and eggs… The one ball changed the direction of the other."
Write Interaction above the 'BEFORE & AFTER' chart. INTERACTION OBJECT BEFORE AFTER	"Changes are clues that tell us that objects have done something to each other. When one object changes another object, the objects are interacting. When a change happens, you are seeing interaction." "There are many interactions in the world around us. We only need to look around to observe interaction. I want you to think of at least five examples of objects you have seen interacting." (Answers will vary- help your children to think of before - after) "What were the objects like before interaction? … After interaction?"
3. You may want to give several examples and have your children describe the interaction. I have given several. Make up as many as you think necessary.	"A pitcher throws the ball. The batter swings and hits the ball. What interaction occurs?" "Describe the interaction of an artist, his paints, and the canvas. "

ACTIVITY 5
OBJECTS TOGETHER

MATERIALS
yarn, about 2 feet
pencil, not sharpened
pencil sharpener
shoe
shoe polish, brush, and cloth
toothbrush
toothpaste
cup
silverware
plate
glass

OVERVIEW
NAMING THE CONCEPT: SYSTEM

LESSON PLAN

WHAT I AM TO DO	WHAT I AM TO SAY
1. Give your children the non-sharpened pencil, and pencil sharpening.	
	"I want you to make these two objects interact. Have them interact over a piece of paper."
	"What is the evidence of interaction?"
	"Describe how the objects have changed?"
	"What can these objects do together that they could not do alone?"
Have each child put his hand, pencil, pencil sharpener, and pencil shavings on the table next to each other. Then encircle these objects with the piece of yarn.	
	"These objects go together in a special way "
Have your children write in their notebook: Pencil Pencil sharpener Pencil shavings Hand	
	"Draw a circle around these words because they go together in a special way."

ACTIVITY 8
SINGLE SPEED BICYCLES

MATERIALS
bicycle, a single speed bike is best for this activity

OVERVIEW
EXPANDING THE CONCEPT: SYSTEMS & INTERACTIONS

LESSON PLANS

WHAT I AM TO DO	WHAT I AM TO SAY
1. The study of a bicycle is an excellent example of interactions. At first use a bicycle that has only one speed or focus upon only one speed of a multiple speed bike.	
	"Describe how a bicycle works."
	"How does the power from your legs move through the bicycle?"
Draw these interactions as your children tell them to you. Have them write them in their notebook. Legs ⟶ Peddles Peddles ⟶ Crank Crank ⟶ Chainwheel Chainwheel ⟶ Chain ⟶ Sprocket Sprocket ⟶ Back Wheel	"Ride the bicycle. As you do so, describe the interaction." (Answer: the energy moves from my legs to the peddles; from the peddles to the crank; from the crank to the chainwheel; from the chainwheel through the chain to the rear sprocket; from the sprocket to the back wheel.)
	"Look at the chainwheel and the rear sprocket."
	"How are they alike? How are they different?"
	"Turn your bicycle upside down."
	"Turn the crank."
	"Are the crank and rear sprocket interacting?"
	"What evidence do you have to support your answer?"
	"Observe closely what happens as I turn the crank."
	"Which way does the crank turn? …Which way does the sprocket turn? … Do they turn in the same or opposite directions? … Do they turn at the same speed or at different speeds?"

“Make a sketch of the interaction.”

“Count the number of teeth on the chainwheel.”

“Count the number of teeth on the sprocket.”

“Do they have the same number of teeth?”

“Write these numbers in your notebook.”

“If I turned the crank around one time, how many times do you think the tire will turn? Why do you think so?”

“I will turn the crank one time around. Count how many times the wheel turns? Is that what you had expected?”

“What affect does the size of the chainwheel and sprocket have on how the bicycle works? Do you see a mathematical relationship between the sprocket sizes and the number of turns of the wheel?” (Answer: For example, one of our bicycles has a chainwheel with 34 teeth and the rear sprocket with 17 teeth. Since 17 times 2 equals 34, the rear sprocket, and therefore the rear wheel, turns twice for one rotation of the chain wheel.)

“What would happen if the chainwheel and the rear sprocket were the same size? What affect would this have on how the wheel would turn?”

“What would happen if the chainwheel were smaller than the rear sprocket? What affect would this have on how the wheel would turn?”

ACTIVITY 9
MULTISPEED BICYCLES

MATERIALS
bicycle with 5, 10, or 21 speeds

OVERVIEW
EXPANDING THE CONCEPT: SYSTEMS & INTERACTIONS

LESSON PLAN

WHAT I AM TO DO	WHAT I AM TO SAY
1. Have your children ride a multispeed bicycle. Have them shift through the various gears as they ride.	"How is a multiple speed bicycle different from a single speed bicycle?" "What are the properties of this system? How is this gear-chain system the same as a single speed bicycle? How is it different?" "Turn the bicycle upside down to investigate how a multiple speed bicycle works." "Describe how the crank and sprocket are turning… Are they turning in the same direction? At the same rate?" "Can you change the rate? How?"
A standard 5-speed bicycle will have only 1 chainwheel and 5 different rear sprockets. A standard 10-speed bicycle will have 2 chainwheels and 5 rear sprockets. A standard 21-speed bicycle will have 3 chainwheels and 7 rear sprockets.	"Count the number of teeth on each of the chainwheels." "Count the number of teeth on each of the sprockets." "Record your data in your notebook."

	Rear Sprockets smallest to largest						
	1	2	3	4	5	6	7
Large Chainwheel							
Medium Chainwheel							
Small Chainwheel							

"There is a diagonal line through each small box. On the upper side of the diagonal line write the number of teeth on the appropriate chainwheel. On the underneath side of the diagonal write the number of teeth on the appropriate rear sprocket. For example, if the large chainwheel had 34 teeth and the smallest sprocket has 17 teeth, then it would look like this:

“Look at the first box. How many teeth are on the large chainwheel? How many teeth are on the small rear sprocket?”

“Are there the same number of teeth on each? Which has more teeth? What affect will this have on the bicycle?”

“If I turned the crank around one time, how many times do you think the tire will turn? Why do you think so?”

“I will turn the crank one time around. Count how many times the wheel turns? Is that what you had expected?”

“What affect does the number of teeth on the chainwheel and sprocket have on how the bicycle works? Do you see a mathematical relationship between the number of teeth on the rear sprocket, the number of teeth on the chainwheel, and the number of rotations of the wheel?”

“Look at several of the chainwheel/rear sprocket relationships. Predict how many times the tire will rotate if the chainwheel is turned one time for each specific chainwheel/rear sprocket relationship.”

“Test your predictions.”

“What is the mathematical relationship between the number of teeth on the chainwheel and the number of teeth on the rear sprocket?”

“In which gear will you get the greatest number of rotations of the rear wheel with one turn of the crank?”

“Test your prediction.”

“In which gear will you get the fewest number of rotations of the rear wheel with one turn of the crank?”

“Test your prediction.”

“What do you think now? … Is there a mathematical relationship between the number of teeth on the chainwheel, the number of teeth on the rear sprocket, and the number of rotations of the tire?”

“What is the advantage of a multiple speed bicycle?”

ACTIVITY 11
ELECTRICAL SYSTEMS

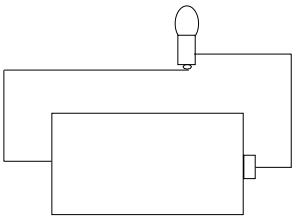
MATERIALS
battery (dry cell), 'D', one new battery; one old battery
wire, insulated
flashlight bulb

OVERVIEW
EXPANDING THE CONCEPT: SYSTEMS & INTERACTION

LESSON PLAN

WHAT I AM TO DO	WHAT I AM TO SAY
1. Show your children 4 or 5 electrical appliances (for example: An iron, toaster, radio, fan, lamp, etc.)	"What do these objects all have in common?" (Answer: An electrical cord) "These objects and many more all involve the use of an electrical system."
2. Give your children a new battery, bulb, and 1 wire. If the wire is insulated, then scrape off some of the insulation at each end. Let your children have plenty of time for exploration.	"Put the battery, bulb, and 1 wire together so that the light bulb will light." "How else can you arrange the system so that the bulb will come on?" "Is there any other way the system can be put together?" "Where does the light bulb need to be touched for it to light?" "What about the battery?" "Does it matter which end of the battery the bulb touches?" "Make a drawing of the different ways you put the electrical system together."
3. Give your children another wire, and some masking tape…	

Electrical Circuit



"Make a new system by adding a second wire."

"See if you can make this system interact?"

"You can use the tape to help hold the wire to the ends of the battery."

"Make a drawing of this new electrical system."

"How is it different from your first drawings?"

"How is it similar?"

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4. Write Electrical Circuit above their drawings.

"There is a special name for the electrical systems you have made. These systems are called an Electrical Circuit."

"An electrical circuit provides a path for electricity so that the bulb will light."

"Change your system again to make a different circuit?

"Make a drawing of any new systems."

"Can other objects be used to make the light bulb light?"

"How could you find out?"

If your children need help…

"Tape one wire to each end of the battery."

"Tape one wire to the side of the bulb."

"Does the bulb light?" (Answer: No)

"Why doesn't the bulb light?"
(Answer: Because there is a gap in the circuit)

"What do you need to do in order for the bulb to light?" (Answer: Touch the other wire to the bottom of the bulb)

"Touch the wire at the bottom of the bulb and see what happens."

"Move the wire so that it does not touch the bottom of the bulb."

"What happens to the bulb?"

"This arrangement of the battery, bulb, and wires is called a Circuit Tester."

"When the bulb lights, there are no gaps in the circuit. It makes a complete path, and is called a Closed Circuit."

"Make a closed circuit with your objects."

"Make a drawing of a closed circuit and label it."

"Separate the wire from the bottom of the bulb."

"Is this a closed circuit? … What is your evidence?"

"Now electricity is not reaching the bulb and the bulb does not light."

"This is called an Open Circuit."

"Make a drawing of your open circuit and label it."

"How is a closed circuit different from an open circuit?"

"How can we use our circuit tester to find out if other objects can be used to make the bulb light? (Let your children suggest possibilities)

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5. Give your children a key…

"Touch one end of the key to the wire….Touch the other end to the light bulb."

"What happens?"

"Is it an open or closed circuit? … What is your evidence?"

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6. Have your children make the following chart in their notebook:

Objects Tested in a Circuit

Object	Bulb Lights	Bulb Does Not Light

"Try as many objects as you can with your circuit tester. Keep a record of what you observe in this chart."

"What objects did you find that closed the circuit?"

"What do these objects have in common?"

"What objects did not close the circuit?"

"What evidence shows that you have a closed circuit? … An open circuit?"

7. Give your children an old battery.

"Use this battery instead of the other battery."

"Is there any interaction? … What is your evidence?"

"How is it different from the other circuit? (Answer: Bulb not as bright, or not lit.)

"What is the problem? …
What could cause it to be different?"

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8. Give your children a working battery, bulb, and wire.

"Make an open circuit."

"Why does the bulb not light?"

"Now make the bulb light."

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9. Read the following verses from the Bible: Ephesians 5:8; I Peter 2:9.

"What does this say about darkness and light?"

"Why is a person in darkness?"
(Answer: Because he is not properly connected to God through Christ.)

Read the following verses from the Bible: Matthew 4:16; John 1:9; John 8:12.

"What have others said about Jesus?"

"What did Jesus say about himself?"

Read the following verses from the Bible: John 12:36; Ephesians 5:8; I Thes. 5:5; Matthew 5:14; I Peter 1:3-4.

"What do these verses say about a person who has trusted in Jesus?"

"Just as when the light bulb is properly connected to the batter by the wire, the bulb lights, so to only when we abide in Christ by faith does man become what he was intended to be - a reflection of the light of Christ."