

Colorado Mountain Club
 Youth Education Program
 TOPIC: SCIENCE OF CLIMBING 5TH GRADE

PROGRAM OVERVIEW	
Audience:	5 TH GRADE
Theme:	Climbers have unique adaptations
Time frame:	3 hrs: 1 hour: science activities; 30 min. lunch; 1.5 hours: climbing wall
Location:	AMC
Goals:	<p>Participants will:</p> <ul style="list-style-type: none"> • Try rock climbing on the indoor wall. • Recognize characteristics of alpine ecosystems. • Become aware of general adaptations and/or equipment that humans and other animal climbers use.
Objectives:	<p>Participants will:</p> <ul style="list-style-type: none"> • Try at least one rock climbing route with a certified CMC belayer tying all knots, double checking equipment and conducting the belaying. • Name three adaptations that alpine animals have to help them climb. • Discuss how human climbing equipment, such as climbing shoes; are similar to adaptations that wildlife have.
Materials:	<ul style="list-style-type: none"> • Climbing equipment: ropes, helmets, harnesses, belay devices & carabiners • Photo cubes of wildlife: mtn. goat, bighorn sheep, marmot, spider, mtn. lion & pika • Wildlife station signs and set of informational index cards • Rulers • Mountain Goat Model • Rubber hooves • Pictures of Alpine environments, mountain goat and human climbers • Worksheets (clipboards if necessary) & pencils • 4 sets of foam blocks—one short leg and long leg body • 4 angle boards
Resources:	<p>Young, Mary Taylor; <u>On the Trail of Colorado Critters</u> Fisher, Pattie & Hartson; <u>Mammals of the Rocky Mountains</u> Readers Digest; <u>How the Body Works</u></p>
State content standards	<p>Geography - 1.2: Knowledge of Earth. Geography - 3: PHYSICAL PROCESSES SHAPING THE EARTH. Geography - 3.2: Physical Systems. Geography - 5: INTERACTION BETWEEN HUMANS AND PHYSICAL SYSTEMS; RESOURCES. Geography - 5.1: Human Modifications of Physical Environment. Reading and Writing - 4: Thinking Skills. Reading and Writing - 5: Locating Relevant Information. Reading and Writing - 6: Record of Human Experience. Science- 3: LIFE SCIENCE Science - 3.3: Human Body. Science - 5: SCIENCE, TECHNOLOGY, AND HUMAN ACTIVITY Physical Education - 1: Skills. Physical Education - 2: Physical Fitness. Physical Education - 3: Participation.</p> <p>Environmental objective: To interest student participation in outdoor activities in Colorado's mountains, and to foster connections between Colorado's urban population and natural areas. Educational objective: Awareness and Knowledge Building, Critical Thinking, Cooperative Learning, Problem Solving, and Taking Responsibility and Action</p>

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SCHEDULE FOR OVERALL PROGRAM	
TIME	ACTIVITY
5 min	Introduction- CMC, AMC, Background of Instructors; Split into two small groups
Background 5 min	<p>WHY Do People and Animals CLIMB? Travel over unavoidable terrain, food, escape predation, shelter, fun and recreation. What enables us to climb rocks? Strong legs, feet, hands & fingers, friction. List a few animals that would have a hard time climbing rocks: fish, slug, toad What makes climbing difficult? The steepness of the slope, gravity, lack of strength, lack of friction. People and animals that live and travel among rocks develop adaptations to help them over come these challenges and allowing them to climb. Define adaptation: <i>An alteration or adjustment in structure or habits by which animals improve its conditions or body in relationship to its surrounding environment</i></p>
5 min	<p>Activity 1: Alpine Ecosystems Students identify characteristics through observation. Discuss vegetation, weather, rock, altitude, etc. by looking at photos. List adaptations that residential animals of the Rocky Mountains would undergo to survive in alpine environments.</p>
15 min	<p>Activity 2: Wildlife Roll Students learn about animals that live year-round within alpine environments, while rolling dice and recording facts about different species. Students will recognize adaptation that allows each species to climb.</p>
10 min	<p>Activity 3: A look at the Mountain Goat Students recognize SPECIAL ADAPTATIONS that contribute to the mountain goats survival in alpine ecosystems. Mountain goats are seldomly found blow alpine and sub-alpine environments.</p> <ol style="list-style-type: none"> a. Fur: types- guard hair and insulation fur; camouflage b. Feet: hooves- have “suction cups” on their hoofs; soft, spongy bottoms to help them stick to the ice and steep rocks c. Body Composition: Center of gravity; balance
10 min	<p>Activity 4: Using Angles to discover center of balance and to recognize anatomy Students recognize SPECIAL ADAPTATIONS for Climbers versus non-climbers</p> <ol style="list-style-type: none"> a. Bones: look at leg length of climbers versus non climbers b. Body construction: weight distribution <p>(Optional Activity 7): SPECIAL ADAPTATIONS/ACTIONS TO GRASP ROCKS. Joints: Opposable thumb activity – tape thumbs down with masking tape and conduct a relay race to pick up a small rock with one hand and bring it back in the pile.</p>
10 min	<p>Activity 5: Owls and Crows Students will play a true/false game which will review information learned.</p>
5-10 min	<p>Optional Activity 6&7: Human ADAPTATIONS & modifications for climbing rock</p> <ol style="list-style-type: none"> a. The Opposable thumb b. CONSERVE ENERGY: Bones, tendons and muscles c. Rock Climbing Shoes and other climbing equipment
5 min	Clean-up classroom; Break for Lunch

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DETAILED ACTIVITY PLANS

Intro

5 minutes

CMC: Established in 1912, the CMC has more than 10,000 members who learn about, conserve and explore our mountains. CMC is a non-profit organization with the primary purposes of education, conservation and recreation.

AMC: The American Mountaineering Center was originally the Golden Junior High school, built in the 1920's. After sitting empty for several decades, it was restored to become the American Mountaineering Center. When complete, it will house the largest mountaineering library in the USA, a mountaineering museum co-sponsored with National Geographic, 350 seat auditorium, and home of 8 non-profit organizations, including the CMC, American Alpine Club, Outward Bound, and several others.

Program agenda: Split into two small group if class size is greater than 15; Groups will rotate through two activity stations
1 hour classroom science activities & 30 min. lunch
1 hr. 30 min. at climbing wall

Topic: The Science of Climbing – specifically some of the adaptations that wildlife and humans have for climbing.

DETAILED BACKGROUND INFORMATION for Instructor:

Mountain Goat



Ruminant (bovid species *Oreamnos americanus*) of the Yukon to the N Rockies that is more closely related to antelopes than to goats. Stocky, with a hump at the withers, mountain goats stand about 40 in. (1 m) at the shoulder. Both sexes bear short, hollow, slightly backward-curving, black horns. The shaggy, coarse guard hair covers a thick, woolly insulating under-fur, and a beard frames the slender muzzle. The hooves are black. Hooves contain soft, spongy bottoms that work like suction cups to hold goats on steep terrain. Mountain goats are agile climbers and can leap more than 12 ft (3.5 m). They live in small bands above the timberline, often found around steep rocky slopes, eating moss, lichen, and scrub foliage. In Colorado goats can be viewed on Mount Evans, the Collegiate peaks and San Juan mountains.
Main body characteristics: split hooves, short legs, and heavy coat.

Activity 1: Alpine Ecosystems

Time frame: 5-10 minutes

References: Photos on CMC classroom wall

Materials: CO Alpine life zone poster; CO 14ers photos

Goal: Students will recognize summer and winter alpine ecosystems while identifying characteristics such as: vegetation, weather, rock, altitude, etc.

Objectives: Observe pictures on wall to show alpine environments

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Activity 2:	Animal Adaptations; Wildlife Roll
Time Frame:	20 minutes
References:	Internet photos; Mammals of the Rocky Mountains; On the Trail of Colorado Critters
Materials:	6 Wildlife Dice; Wildlife fact index cards with envelopes; Wildlife station signs; Wildlife matching worksheet
Goal:	Students will learn about Colorado's alpine wildlife, while discovering special adaptations for climbing in alpine ecosystems.
Objective:	<ol style="list-style-type: none"> 1. Distribute students evenly amongst 6 stations 2. Each student will roll the dice and then proceed to the station that matches what is on dice 3. At the station the student will read 5 facts about the animal and mark on the wildlife matching worksheet the one fact that best describes that animal's adaptation for climbing 4. The student will then roll the dice again and proceed to the next station; Repeat. <ul style="list-style-type: none"> • If a student rolls the dice and rolls a station they have already visited, have them roll the dice again • Each student will visit each station once • Students may record three additional facts about animals they learned about during the activity.
Activity 3:	A look at the Mountain Goat; Special Adaptations
Time Frame:	10 minutes
References:	<u>On the trail of Colorado Critters</u>
Materials:	Mountain Goat Mount; rubber hooves; rulers; pencils; worksheet
Goal:	Students will recognize special adaptations that contribute to the mountain goat's survival in alpine ecosystems
Objectives:	<p>Students will:</p> <ul style="list-style-type: none"> • Feel the fur on the mountain goat mount and observe special characteristics of the fur • Observe the mountain goat's body size and structure to determine what food the mountain goat eats • Look at special characteristics of the hooves on the mountain goat • Measure mountain goats hoof and look at field guide photos to determine if length was correct
Outline:	<p>Students will:</p> <ol style="list-style-type: none"> 1. Feel and observe the mountain goat's fur by coming up in pairs 2. Each get a rubber hoof to observe, trace and measure 3. Learn about the hoof in detail 4. Be able to recognize a mountain goat hoof
Activity 4:	Using Angles to discover that Balance (Center of Gravity)
Time Frame:	10 minutes
References:	
Materials:	Angle Boards, model animal foam shapes
Goal:	<p>Students will:</p> <ol style="list-style-type: none"> 1. Recognize special adaptations for climbers versus non-climbers; anatomy is the key to climbing

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	2. Understand the concept of center of gravity and how it is related to climbing 3. Observe how friction helps us climb-- more friction between two surfaces, better
Objectives:	Students will: Create model "animals" from foam shapes that have different centers of gravity and predict which models are best adapted for climbing.
Outline:	1. Set up angle boards 2. Each group will test model on angle board to see what shape is best for climbing
Activity 5:	Owls and Crows: True or False tag game
Time Frame:	10-15 minutes
Materials:	Short piece of rope; two orange cones; True and False signs; large area to run
Goal:	Students will review the information they learned through an active game.
Objectives:	Students will answer true or false questions by running to the appropriate cone/sign.
Outline:	1. Place rope on the ground in the center of the room. Place cones 30 ft. on both sides of the rope. One side represent 'TRUE' and the other 'FALSE'. 2. Split students into two small groups and have them line up across from each other along the rope. 3. The side of the rope where the True sign lies will be the 'True Owls' and the other side of the rope will be the 'False Turtles.' 3. Explain that you will be playing a tag game which involves you asking questions, and that one group are turtles and the other are owls. The students will answer the questions by running to the side of rope with the right answer. Establish the true side and false side of the ropes and safety zones (cones or signs). 4. Explain that if you ask a questions and the answer is true, the 'True Owls' will run to the true sign while the 'False Turtles' chase them. If a turtle tags an owl before arriving at the safety sign, the turtle will escort the owl to the other side of the line. The owl will now be a turtle to and vice versa. 5. Remind students to come back to the rope after everyone has run. Play until you run out of questions. Review each answer before asking the next so students understand that they may be wrong.
Activity 6:	Optional Activity: Special Adaptations to Grasp Rocks (Opposable Thumb)
Time frame	5-10 minutes
Materials:	Masking Tape; small rock
Goal:	Students will learn about the importance of joints
Objectives:	Students will: Tape thumbs down with masking tape and conduct a relay race to pick up a small rock with one hand and bring it back in the pile.
Outline:	Split students into relay teams. Establish running area with starting point and pile of small rocks to collect. Have teams race to see who collect the most rocks. Explain the benefit of having a thumb. Have students discuss different animal adaptations and those that contain thumbs—what things/tasks can animals with a thumb accomplish.

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Activity 7:	Optional Activity: Special human adaptations and modifications to conserve energy while climbing—Tendons, Muscles and Bones
Time frame	20 minutes
References:	<u>How the Body Works</u>
Materials needed:	Climbing shoe Piece of static and dynamic climbing rope Flat ground
Goal:	Students will understand ways to use their bones, joints, tendons and muscles to climb more easily.
Objectives:	Students will: 1. Learn about conserving energy: Bones, tendons, and muscles 2. Discuss rock climbing shoes and other climbing equipment that helps with climbing 3. Conduct several simple experiments on their own body to discover ways to prevent fatigue tendons in resting mode. 4. Conduct balance test on their classmates. Standing straight up, bending over on all four with straight legs and then bent legs (knees) on the floor
Activity 8:	GRAVITY: Big obstacle to climbing
Time frame	10 min
References:	Website
Materials needed:	Orange, grape, newspaper
Goal:	Students will associate the force gravity as an obstacle that must be overcome in climbing.
Objectives:	Students will: <ul style="list-style-type: none"> • Observe the force of gravity on an orange and grape, and compare the relative speed they fall toward the earth. • Make predictions that the greater the distance an object falls, the greater impact, or possibility of injury it will have.
Outline: Outline Continued:	<i>The Force of Gravity:</i> gravity is commonly indicates that force in operation between the earth and other bodies, i.e., the force acting to draw bodies toward the earth. The force tending to hold objects to the earth's surface depends not only on the earth's gravitational <u>field</u> but also on other factors, such as the earth's rotation. The measure of the force of gravity on a given body is the <u>weight</u> of that body; although the mass of a body does not vary with location, its weight does vary. It is found that at any given location, all objects are accelerated equally by the force of gravity, observed differences being due to differences in air resistance, etc
CLOSURE	
Time frame:	5 minutes
Clean-up	Pick up all trash. Put chairs and tables back to original locations. Put away all program materials. Turn off A/V, lights, heat, and lock door.

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KEY VOCABULARY WORDS	
Word	Definition
Adaptation	Modification of an organism or its parts that makes it more fit for existence under the conditions of its environment
Opposable thumb	The joint of the thumb is opposite of the other finger joints, allowing specialized grasping movement of the hand
Gravity	Universal force of attraction that acts between all bodies that have mass
Balance	To bring into or keep in equal or satisfying proportion or harmony
Center of gravity	The point at which the entire weight of a body may be considered as concentrated so that if supported at this point the body would remain in equilibrium in any position
Hoof	The hoof is dermal tissue, comparable to the human fingernail that extends over the end of a broadened terminal digit. Mammals with hooves are called ungulates
Climbing shoes	Special shoes with sticky rubber soles, used by rock climbers. There are many different styles
Behavior	Anything an animal does involving action and/or response to stimulation
Camouflage	Coloration that blends in with the surrounding environment
Conservation	Taking care of our environment by wisely managing its resources
Ecosystem	A unit of plants, animals, and nonliving components of an environment that interact
Environment	The total surroundings and forces that act upon a living thing
Endangered species	A species of plant or animal of which numbers are decreasing at an alarming rate and is threatened with extinction by human-made or natural changes in the environment
Extinct	No longer existing on the Earth
Habitat	The place where an animal lives; includes food, water, shelter and space
Herbivore	An animal that eats only plants
Carnivore	An animal that eats only animals
Omnivore	An animal that eats both plants and animals
Invertebrate	An organism with no backbone
Predator	An animal that eats other animals
Prey	V: to hunt and eat other animals. n: an animal eaten by another animal
Vertebrate	An organism with a backbone

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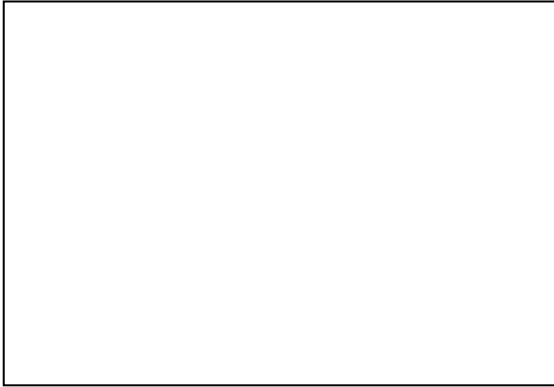
Owls and Crows: True/False questions

1. Mountain goats are not mammals.
2. Mountain Goats' favorite food is twigs and branches.
3. B big horn sheep stay in the alpine environment all year long.
4. Ungulates are animals with hooves, which are like our fingernails.
5. Gravity is an important idea in rock climbing.
6. A mountain goat is an ungulate.
7. Mountain goats live in the desert as well as the mountains.
8. The best animal rock climbers have really long legs.
9. Mountain goats are native animals to Colorado.
10. Pika and Marmots live in the alpine life zone, too.
11. Adaptations are special characteristics of organisms

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Animals have ADAPTATIONS that help them to live. Some animals have special adaptations to help them climb rocks high in the mountains.

LEGS match the animal's movement



SHORT LEGS are good for: _____

LONG LEGS are good for: _____

An animals **COAT** protects it from the severe climate in the alpine environment. Describe the mountain goat's coat in words.

Circle the right answer

HOOVES are like our: bones fingernails muscles

FEET: Draw the mountain goat hooves.

The hoof is _____ inches wide and _____ long.

Alpine and Sub-alpine Wildlife Matching

Directions: Draw a line connecting each word with the correct climbing adaptation

Bighorn Sheep	Short, powerful, muscular limbs; broad feet; retractile sharp, curved claws, and large hind legs
Pika	Very short, powerful legs, flattened feet with curved claws and nails
Mountain Lion	Sturdy legs; spongy, sharp-edged hooves
Marmot	Dense hair tufts under the claws of their feet (tarsi)
Mountain Goat	Large, oval hooves with rubber-like, spongy soles
Spider	Front and rear legs are very short and equal in length

Write three cool facts you learned about any of the wildlife from the cards (different than the facts listed above):

1. _____

2. _____

3. _____

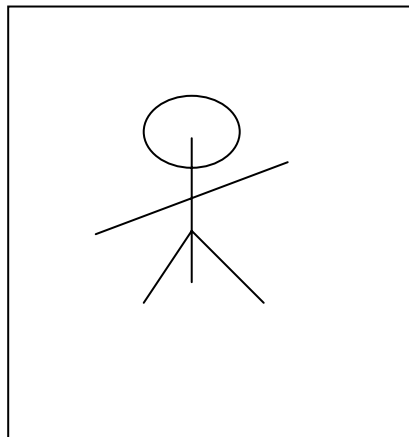
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STUDENT EVALUATION Questions—optional

Why do animals and people CLIMB rocks & mountains?

What are some obstacles to climbing?

Where is your CENTER OF BALANCE?



What was the hardest part about climbing for you?

What was the most fun part about climbing for you?

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Pre- Activity 1

GOAL: To recognize each others differences and build support among a group.

Challenge Circles

Purpose:	Students will be able to: <ol style="list-style-type: none"> 1. Understand the importance of respecting and supporting their own and other students' decisions regarding personal level of challenge. 2. Identify reliable behaviors that offer physical and emotional support 3. Understand the value of expressing their feelings in a supportive environment
Materials:	Play ropes of various lengths
Timeframe:	15 minutes
Procedure:	<ol style="list-style-type: none"> 1. Use the play ropes to create two concentric circles on the ground. There should be about four feet between each of the rope circles. The inner circle should be large enough so that the entire class could stand inside. Circle the whole group up around the outer circle. Show students that the inner circle represents one's comfort zone, the middle circle one's stretch zone and the outer circle the panic zone, which can extend out quite far. 2. Tell students that this is a Challenge by Choice activity and "Everyone has a comfort zone, a stretch zone and a panic zone; Challenge by Choice says that you should try to stay in your stretch zone. But, does everyone have the same comfort zone, stretch zone and panic zones?" 3. Give examples of each zone (i.e. riding the bus with friends is a comfort zone) 4. Call out a topic such as snakes or cooking, etc... 5. Students are to go to the zone where that topic puts them. 6. After each round, have students look around and notice the diversity of responses 7. Optional: Have students call out the topics

Source: Adventure Curriculum for Physical Education; Jane Panicucci

Discussion:

Ask students:

1. Did people usually end up in different places? What does that mean about this class?
2. What does it mean when someone chooses to participate in a way that is different from others?

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Pre- Activity 2

GOAL: To build respect and trust among a group.

I Trust You But....

Purpose:	Students will be able to: 1. Understand that progressive personal challenges, within a safe environment, can lead to increased self-awareness and learning opportunities 2. Learn the importance of respecting and supporting the different decisions of others regarding personal levels of challenge
Timeframe:	40 minutes
Materials:	Blindfold (optional)
Procedure:	<ol style="list-style-type: none"> 1. Students have the choice to walk, jog or run. The class will be there to support and spot each level of challenge. 2. If you do this activity outside, have the first student walk across the field to a good distance away (75 yards or so). This person is now the runner. Ask the runner to take a look back at the group, then to shut his or her eyes or put on the blindfold. The rest of the class should position themselves in a cone-shaped configuration at the runner's destination point. The runner is to run, blindfolded, toward the group. The group's job is not to let the runner stray too far and to stop the runner when he or she gets to the stopping/destination point. They do this by keeping bumpers up and by gently guiding the runner in the correct direction. 3. Prior to starting, have the blindfolded runner yell to the class, "Ready to spot me?" The class should respond, "Ready." Spotters should remain silent after giving their response. 4. At this point the blindfolded person is to walk, jog, or run at a steady pace toward the ending point. The trick is for the runner to keep this steady pace and to trust that the spotters will keep him or her from harm. 5. Place a few spotters along the route to prevent a wildly erratic runner from going astray.

Source: Adventure Curriculum for Physical Education; Jane Panicucci

Discussion:

Ask Students:

1. Was it hard or easy to trust your classmates to keep you safe?
2. Did anyone feel safer blindfolded than as a spotter?
3. How did it feel to be the only nonsighted person?
4. How can we support each other in future activities when things get hard or scary?
How about places other than class?
5. Did you feel that it was OK to not do this activity? To choose "no"? Did the class support this?

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POST FIELD TRIP ACTIVITY 1: What is Adaptation?

Materials Needed	Pictures of people living, working, and playing in different climates; Newsprint
Procedure	<p>1. Adaptation in plants and animals refers to the way they can adjust or change to be able to live where and how they do. Many animals and plants live only in certain places. People have made adaptations so they can live for periods of time almost anywhere. Discuss some of the adaptations that have been made by you and others to enable you to be comfortable in your classroom today. List some important ones on the board.</p> <p>2. Divide into groups of four or five and look at the pictures of ways people adapt to live, work and play all over the world. Make a list of some ways humans are different from other animals in their ability to adapt.</p> <p>3. From your pictures, choose the most interesting adaptations and share them with the class.</p>
Further application	Select a favorite animal that you have not already studied. Study its habitats and lifestyle in depth and identify as many of its adaptations as you can.
Skills	Observing, inferring, classifying, communicating, comparing and contrasting, using space-time relationships, formulating hypotheses, identifying and controlling variables, researching

Source: www.teachervision.com/lesson-plans/lesson-6990.html

Post Field Trip Activity 2: GRAVITY Down!

Purpose:	To Understand the pull of Gravity
Materials Needed:	24-inch (60-cm) string; 3/8-by-36-inch (0.94-by-90-cm) dowel paper clip
Procedure	<p>1. Tie one end of the string to the center of the dowel.</p> <p>2. Secure the paper clip to the free end of the string.</p> <p>3. Hold the dowel horizontally, one end in each hand, about 12 inches in front of your face. Observe the position in which the paper clip is hanging.</p> <p>4. Tilt the dowel so that one end bends down and almost touches the string. Observe any change in the position in which the paper clip is hanging.</p> <p>5. Return the dowel to a horizontal position and repeat step 4, tilting the other end down until it almost touches the string.</p>
Results	The paper clip hangs down regardless of which way the dowel is tilted.
Reasons why?	The paper clip is free-hanging, meaning that it is held in place only by the string and is free to swing in any direction. Earth's gravity (a force of attracting between all objects in the universe) pulls the paper clip down, toward the center of the Earth. When you tilt the dowel, the string does not tilt with the rod, so the paper clip continues to be pulled in the same direction by gravity. On or near Earth's surface, gravity pulls everything toward the center of the Earth.

Source: [Teaching the Fun of Science](#), Janice VanCleave's: Page 30