

# Secondary Science Resource Kit

Integrating Creative  
Technology Tools into  
Your Science Program





## Digital Animation in Secondary Math and Science

Creating meaningful connections

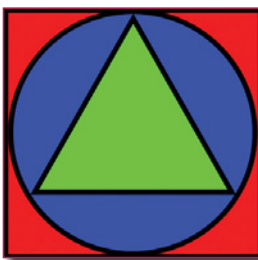
By Bradley Smrstick

As digital multimedia tools become more affordable and easy to use, they also become increasingly appropriate for the classroom learning environment. Current research indicates that digital video affords new opportunities for learning, and the professional education associations for science, social studies, mathematics, and English language arts are devoting extensive consideration to the application of digital video technologies to strengthen student learning (Bull and Bell, 2008). Student-created animation is a perfect example of a visual technology that can increase understanding and engage students in the secondary science and mathematics classroom.

In both math and science, students are often asked to remember the steps to complex systems. When students spend their time memorizing answers, rather than understanding and internalizing new material, they are less likely to create links between their prior knowledge and what they are studying. This new “knowledge” is often only short term, likely to be lost or forgotten after the test or quiz has taken place. Digital animation offers an alternative to this process, providing a vehicle for students to create their own meaningful connections with the content. Students who produce their own unique graphics for a mathematical animation are creating their own interactive Visual Mathematical Representations

(VMRs), which, in my experience, has a far greater impact on their learning than using pre-existing images to create an animation or watching an existing animation.

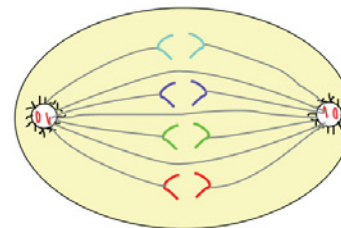
When students must simultaneously keep several pieces of information in mind while learning something new, it is advantageous to reduce cognitive load by providing depicted objects and parts of objects proximal to textual discussions (Iding, 2000). Using the drawing tools in Frames, students can produce their own unique computer-based Mathematical Cognitive Tools (MCTs) which support and enhance learning and the cognitive processes of learners (Sedig and Liang, 2006).



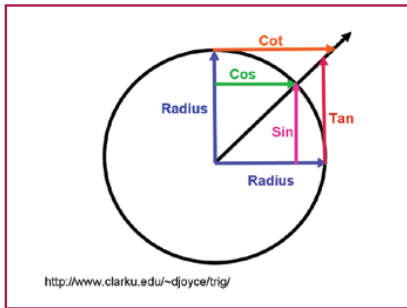
For example, the Unit Circle is the foundation of trigonometry. When students create an animation that contains the basic transcendental functions, they forge their own relationships between the function and its definition. When students animate these graphics for the purpose of describing a mathematical process, they

are also creating an artifact that evidences their understanding of the process.

Research indicates that digital animation projects of this nature can have truly compelling results. Developing original illustrated animations provides a rare opportunity to enrich the curriculum using students’ own creativity. My colleagues and I have noticed increased engagement as students create their own learning objects and take ownership of the material they are learning.



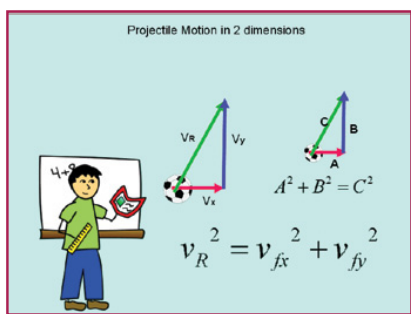
In the animation design process, the Frames drawing tools help students simplify a complex tasks. For example, in the case of cell division, a student can begin by illustrating a cell, and then duplicate the frame, making minor changes to the chromosomes as the cell divides. Duplicating frames in this fashion reduces cognitive load, allowing students to focus their attention of the actual process of cell division. Mayer and colleagues have promoted a generative theory of multimedia design, suggesting that the selection, organization, and integration of to-be-learned information are of benefit in



designed instruction (Mayer and Moreno, 2002).

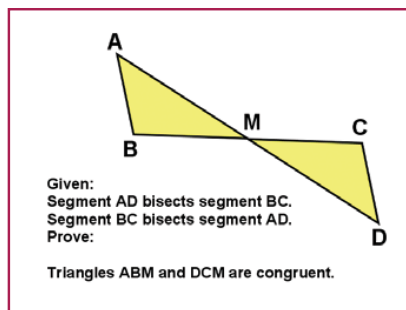
Projectile motion is a fundamental physics concept that describes how objects fall freely under the effects of gravity. Using digital animation tools to describe projectile motion gives students the opportunity to integrate their understanding of two significant mathematical concepts, vector addition and parabolic functions, with their understanding of free-fall. In doing so, students work to overcome any existing misconceptions, ultimately developing a better understanding of the physical system.

Research into cognitive processes has shown that learning is most effective when the learning environment includes four core conditions: active engagement, participation in groups, frequent interaction and feedback, and connections to real-world contexts (Roschelle, Pea, Hoadly, Gordon, and Means, 2000). Using Frames to create digital animations allows you to integrate all four conditions in your math and science classroom. As students create animations, they also



develop their own processes by which they solve an essential question posed by their teacher. This creative freedom allows students to produce an animation that is authentic, relevant, more meaningful.

Geometry is another arena where digital animation can contribute to engagement and understanding. Geometric proofs build the foundation upon which most geometric principals are based. Many students find proofs complicated and difficult to complete. To animate a proof successfully, students must reduce it to individual elements in order to depict visually the necessary connections between each one.



Students are led to develop strategies for solving problems using the software, developing their geometrical thinking as they combine activities with the questions asked during the animation process (Patsiomitou, 2008). The statements in a two column proof act as guiding questions throughout the development of a complete proof. These statements can also serve as a storyboard for development, with the steps of the proof playing out the solution during the final animation.

Integrating animation into your science and math classrooms allows you to engage the boundless creativity each of your students possesses. When you put digital animation tools into the hands of students, you provide them the opportunity to construct their own projects and build their own understanding.

## Bibliography

Bull, G., and Bell, L. (July 2008). Lights, camera, learning! *Learning & Leading with Technology*, 36 (8), 30-31.

Iding, M.K. (2000). "Is seeing believing? Features of effective multimedia for learning science." *International Journal of Instructional Media*, 27(4), 403.

Mayer, R., and Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational Psychology Review*, 14(1), 87-99.

Patsiomitou, S. (2008). The development of students geometrical thinking through transformational processes and interaction techniques in a dynamic geometry environment. *Issues in Informing Science and Information Technology*, 5, 353-393.

Roschelle, J.M., Pea, R.D., Hoadley, C.M., Gordon, D.N., and Means, B.M. (2000). Changing how and what children learn in school with computer-based technologies. *Children and Computer Technology*, 10(2), 76-101.

Sedig, K. and Liang, H.N. (2006). Interactivity of visual mathematical representations: Factors affecting learning and cognitive processes. *Journal of Interactive Learning Research*, 17(2), 179-212.

## Biography



**Bradley Smrstick**

**Bradley Smrstick** is a former high school math and science teacher with more than 20 years of experience in the classroom teaching physics across all levels from conceptual to A.P. He has participated in summer research programs at the FermiLab, Lawrence Livermore National Laboratory, the University of Florida, and the University of South Florida. He now applies his craft as team lead for Technology Training at Staff Development in Hillsborough County, Florida.



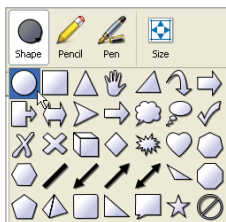
## SNACKS

### Frames™

#### Draw Your Own Animations

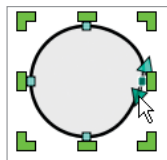
You can draw your own illustrations and characters with the drawing tools in Frames.

Click the **Shape** tool on the toolbar. You will see a panel with lots of different shapes. Click the shape you want to draw.

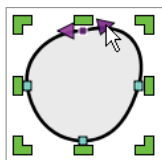


Click and drag on the canvas to draw a shape.

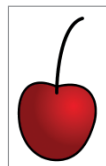
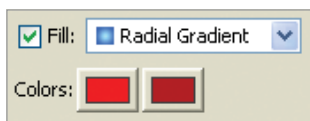
You will see nodes around the shape. Click and drag a **node** to change the shape. Click a node and click and drag the **blue node handles** to change the direction of the stroke through this node.



Double-click a **node** and click and drag the **purple node handles** to change the direction of the stroke on either side of this node. Adjust the nodes and handles to get your shape looking the way you want.



Use the Fill options in the Options panel to change the fill of the shape.



Use the other drawing tools like the Pencil tool to add more pieces to your shape and complete your masterpiece.

Add additional frames and continue drawing your animation.

### Teacher Connection

#### Getting hooked on animation



Cathy Palmer

"Believe it or not, summer camp might be the thing I love most about my job as an Instructional Technology Facilitator! While my district offers a variety of technology-based camps for students each summer, the one I have been drawn to for the past two years has been Animation with Frames.

When I first saw Frames, I wasn't sure I could teach it in four half-day camp sessions. But after playing with it for one hour I was hooked and not only knew it was possible, I knew the rising sixth- to eighth-grade students would love it too.

On the first day, we learned and created animations using the resources offered within Frames. On the second day, I provided a variety of action figures and other manipulative items to be used in creating stop action animations. During the next two days, the students used this knowledge to develop animations on their own.

So why do I, and the campers, love Frames so much? I get to be the 'guide on the side' and watch while their faces light up with excitement over their own creativity. The students love it, in part, because I only talk for about five minutes at a time, and in part because they can explore and create on their own, in pairs, or in small groups.

My favorite part is watching the students develop a passion for the art of animation, storytelling, digital photography, humor... all parts of the creative process that could turn into a lifelong interest or even a vocation.

All it takes is a spark, and Frames has proven to be a fun, engaging, open-ended tool that can provide the opportunity for a spark to grow into a flame."

*For an instructor outline on using Frames in a summer camp setting, go to <http://moodle.feschools.net/course/view.php?id=984> and click on the link for Digital Animation using Frames 4.*





## Frames Project Ideas—Science

Creating illustrated animations, movies, and digital stories engages students in the curriculum, encourages problem solving, promotes creativity, and helps students develop 21st-century skills. Students can use Frames to create animated news broadcasts, digital stories, video biographies, and more to explore the science curriculum.

### Weather and Climate

#### Wind

Imagine that you are a hot-air balloonist. You want to fly your balloon across the continental United States. To achieve the fastest time, would it make more sense to fly east-to-west or west-to-east? Be sure to explain how the prevailing winds influenced your decision as an outdoor activity group is looking to publish your findings in a new guidebook.

#### Weather

The Weather Channel is creating a documentary on hurricanes. You are a hurricane hunter - a scientist who flies into a hurricane to collect data. Create a travelogue on the experiences you have about what it would feel like as you fly through the hurricane's eyewall into its eye.

#### Climate

A group of scientists are looking to find answers about the cause of the last ice age. You have recently come across a time machine that will allow the group to travel back in time to the last ice age. Create an informational video on the type of equipment your group will need to bring to find out more about the causes as well as what the climate will be like.

### Earth

#### Plate Tectonics

Hollywood is looking for a more traditional approach to the movie *Journey to the Center of Earth*. You are to create a travel video on your journey to the center of Earth describing the layers of Earth through which you travel. Be sure to explain how temperature and pressure change beneath the surface.

#### Earthquakes

You are an inventor who has created a simple device that can detect an earthquake. To protect your rights to the invention, you apply for a patent. For the patent application they are asking for a simulation video describing your device and how it will indicate the direction and strength of an earthquake. Be sure to include an illustration labeling your device.

#### Volcanoes

As a travel agent, you are planning a Pacific Ocean cruise that will visit volcanoes in the Ring of Fire and Hawaii. Create a video brochure advertising the types of volcanoes the group will see and explain why the volcanoes formed where they did.

### Chemical Interactions

#### Atoms and Bonding

Pretend that you are the size of an atom, and you are observing a reaction between a potassium atom and a fluorine atom. Create a visual account of an ionic bond as the atoms react. Tell what happens to the valence electrons on each atom and how each atom is changed by losing or gaining electrons.

#### Chemical Reactions

*Cartoon Network* has hired you to create a series of animations on chemistry. Your first cartoon should help young children understand the concept of "activation energy." Be sure to use examples that young children can relate to, such as the burning of wood or gas.

#### Carbon Chemistry

As a chemist you invent a polymer that can be a substitute for a natural material such as wood, cotton, or leather. In order to market your invention you must create a commercial for your polymer, explaining why you think it is a good replacement for the natural material.

### Astronomy

#### Earth, Moon, and Sun

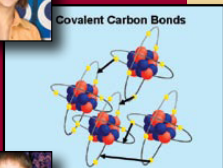
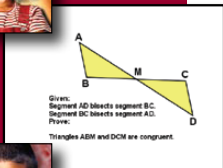
It has been many years since we landed on the moon. Since then the moon has lost popularity amongst space travel and knowledge. NASA has recently hired you to create a public service announcement on the origin of the moon and how it formed.

#### Exploring Space

Imagine that you are a scientist planning the first human expedition to Mars. The government will not fund the project until they have ample information. You will need to create a video for them about some of the major challenges that such a mission would face and provide possible solutions. Think about the physical stresses of space travel and how the crew's basic needs will be met.

#### Solar System

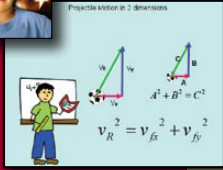
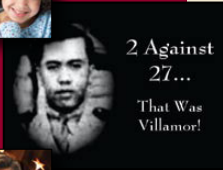
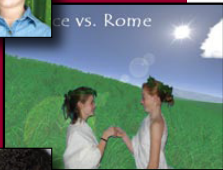
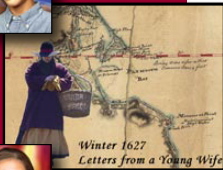
You have been hired by an online intergalactic travel group to create an advertisement for the inner planets other than Earth. Design a video for your selected planet, including basic facts and descriptions of places of interest. Why would individuals choose to visit this planet over others?





# Secondary Science Resource Kit

Frames & Share Project Ideas—Secondary Science p2



## Structure and Function in Living Systems

### Viruses, Bacteria, Protists, & Fungi

You are a detective for the Mold Prevention Agency and have been assigned to create a "Wanted" commercial for a mold that has been ruining food in kitchens. Present the mold as a "criminal of the kitchen". Include detailed descriptions of the mold's physical characteristics, what it needs to grow, how it grows, and any other details that will help families identify this mold. Propose ways to prevent new molds from growing in kitchens.

### Invertebrates

As a television reporter, you are covering a story about a giant squid that has washed up on the local beach. When you arrive there are scientist swarming the creature. Create a news segment describing the discovery, as well as how scientists classified the animal as a squid.

### Vertabrates

As an ornithologist for the San Diego Zoo you have decided to create an informational video for the kiosk at the large bird exhibit. This video should inform visitors about adaptations that enable a large bird to fly.

## Structure and Function in the Human Body

### Bones and Muscles

The local cable network is looking to create a series of animations on personal health. They feel it is important to educate the community on the functions of bones and muscles for proper health. Create an animation comparing the characteristics of cartilage with the characteristics of bones. Be sure to explain the advantages of both types of materials.

### Nervous System

As a brain researcher it is important to understand the relationship of the right and left halves of the brain. You decide to create a public service announcement for individuals to better understand how their brain functions. Compare the functions of the left and right halves of the cerebrum. Discuss what kinds of mental activities each half controls as well as which side of the body it controls.

### Endocrine System

Imagine you just found out that you have an identical twin who was raised in another country. Create a video for them of what you think they would be like. Be sure to include information about what you think they look like, their interests, and unique characteristics they may have. Does environment play a role in any of these?

## Resources That Can Help



[www.thecreativeeducator.com](http://www.thecreativeeducator.com)

Creative Educator magazine features articles on project-based learning, stories from educators, high-level lesson ideas, software tips, and more.



[connect.tech4learning.com](http://connect.tech4learning.com)

Join like-minded educators from around the world to explore how a blend of technology, creativity, and curriculum can inspire 21st-century students!



[www.recipes4success.com/lessons](http://www.recipes4success.com/lessons)

The lessons at Recipes4Success include a step-by-step process for teachers and students, downloadable templates and examples, links to tutorials and references, and correlations to standards.



[tradingpost.tech4learning.com](http://tradingpost.tech4learning.com)

Want to find new ideas? Search the Trading Post for Pixie Activities, WebBlender templates, Twist designs, and more, or share your own lesson ideas!



[www.pics4learning.com](http://www.pics4learning.com)

Pics4Learning contains over 20,000 free copyright-friendly pictures you can use in educational projects.



A storyboard is a combination of outlines and visual sketches that map out the contents and direction of your story. Use this storyboard to show what will happen in each scene of your animation. A scene can be made up of multiple frames.



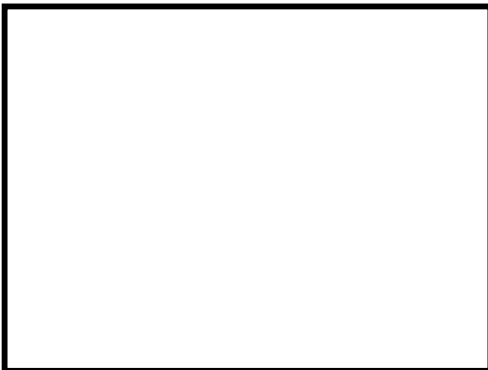
---

---



---

---



---

---



---

---



---

---



---

---



A rubric can help you assess the final project as well as the process along the way. Before students begin, share your expectations for completed projects, as well as explain the work to be performed during the project-building process.

<i>Criteria</i>	<i>Novice</i>	<i>Apprentice</i>	<i>Proficient</i>	<i>Distinguished</i>
<b>Project meets its purpose and skillfully answers the question posed.</b>	Subject knowledge is not evident. Information is confusing. Does not answer the essential question.	Some subject knowledge is evident. Some information is confusing. Question is stated but not clearly answered.	Subject knowledge is evident in much of the product. Information is clear, appropriate, and correct. Essential question is answered.	Project has gone above and beyond. All information is clear, appropriate and correct. Essential question is clearly answered. Subject knowledge is evident throughout.
<b>Quality of Design.</b>  Is it visually pleasing, original, creative, or organized?	Quality is weak. There is no evidence of logical flow or use of new ideas. No visual impact.	Random presentation of material with little attention paid to quality.	Media used demonstrates adequate and clear sequencing of material using creative graphics.	Media shows superior evidence of continuity. There is a logical intuitive sequence of information.
<b>Storyboarding and planning</b>	Did not utilize storyboard during process or storyboard is incomplete.	Basic storyboard. Does not answer essential question. Referred to storyboard during project building process.	Strong storyboard that answers the essential question. Storyboard used as a guideline for project development.	Fully developed storyboard that answers the question and is organized in coherent pieces. Used storyboard extensively during project development for goal-setting, organization
<b>Presentation style including, eye contact, voice, and appearance</b>	No eye contact. Low, soft, or monotone voice. Script reading. Appearance is too casual or sloppy. Posture is slouched.	Some eye contact. Voice is soft or monotone. Appearance is casual, but neat. Presenter rocks back and forth.	Some eye contact, but only in one direction. Voice is steady and clear. Presenter shows some facial expression, uses appropriate gestures, and knows the content well. Presenter is dressed up and has good posture.	Eye contact moves among the audience. Presenter is confident, expressive, and know their content. They are dressed up or in appropriate costume. They have good posture, are mobile, and use facial expressions and gestures to make their point.





## Fastballs, Free Throws and Physics

*Special thanks to Tess Ewart of Medina, Ohio, for sharing this great lesson.*

### Identifiers

#### Grade Level

5–8

#### Subject

Science

#### Duration

2 weeks

#### Objective

Students will illustrate their knowledge of force and motion physics concepts.

#### Description

Students will create an animated video that showcases how physics concepts apply to their favorite sport.

#### Application

Frames™

### Process

#### Authentic Task

Physics helps explain the world around us, but many students can't see this connection and lose interest in science. After a Physical Science unit on Force and Motion, ask students to create an animated video that shows other students how physics explains what happens during different sports activities.

#### Engage

To begin, complete your regular Physical Science unit on Force and Motion. Let students know that as an assessment, they will apply what they learned to create an animated video that explains how physics affects their favorite sport.

Review Newton's three Laws of Motion and review the definitions of friction (including sliding, rolling, fluid, and static), gravity, acceleration, inertia, momentum, velocity, force, projectile motion, and frame of reference. Tell students that they are required to illustrate four of these topics and at least two of Newton's three Laws of Motion in their project.

To ensure quality products, and help students get started, explore examples of past student work that meet project objectives. Then, choose a sport most students are familiar with and work as a class to discuss how a force or motion topic could be illustrated for this sport. For example, asking the class questions

like "Where can you find projectile motion in football?" or "Where can you find friction in tennis?" are great ways to start the discussion. Once they have identified where in football they would find projectile motion or where in tennis they would find friction, ask how they would illustrate that in an animation.

After the class discussion, have students choose the sport they are most interested in as the basis for their project, and identify the four terms and two laws they will illustrate. Have them individually brainstorm how they will illustrate each topic using their sport.

Once students have had time to think through their animations, get the class back together and have them share some of their ideas. This will give you an opportunity to identify and correct any misinformation prior to the animation work. It also gives students ideas that they can use for their own animations.

#### Create

Before students can begin using Frames, they must plan their animation using a project storyboard. Students should think of each box of the storyboard as the computer screen and sketch what will be depicted for each scene. Students should use the storyboard to clearly define and describe the physics terms they are illustrating, thoroughly sketch out what will happen in their animation for each term, and write out the text or narration they will include for each segment. The more detailed the storyboard is, the easier it will be for students to create their animations.

Once the students have completed their storyboards, meet with them individually to discuss what they plan to do for their animation. Then let them begin work on the computer with Frames.

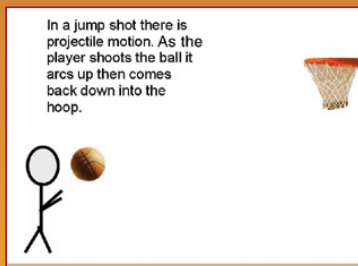


### Steps for Students

#### Create an animated video in Frames™

Students can use Frames to create animated videos that demonstrate how physics can help explain what happens during sports activities.

1. Launch Frames.
2. Click the New blank frame button on the toolbar to add more frames.
3. Click the Library button to add clip art, photos, or images you have collected.
4. Click the Tools button to use drawing tools to create your own illustrations.
5. Click the Clone button on the toolbar to duplicate frames. Make changes to the objects on the frames to create animation.
6. Click the Text tool on the Tools panel to add text. Use the handles and Format options to change how the text looks.
7. Click the Record tool on the Tools panel to add narration.
8. Select a frame or group of frames and adjust the Duration slider on the Tools panel to change the timing.
9. Click the Save button on the toolbar to save the file.
10. Click the Project button and choose *Export* to create an animated movie to share.



Students can use the drawing tools in Frames to create illustrations and animated models of how physics interrelates with the sport they have chosen. Many will also have digital images of themselves playing their sports that will help make the project more meaningful to them.

Students can also add text, adjust timing, and record narration to explain the terms and laws of motion. When the animated movie is complete, students should “make” their movie into a file format that can be shared online or in presentations.

#### Share

Have each student present his or her animated movie to the class. While viewing the animations, ask the students to keep a log of each animation, what they liked about it, and what the author could do to improve it. I also like to post the animations on my school website, so other students can use them for review or extended studies.

#### Assessment

Use the student’s storyboard as a formative assessment to see how well each student understands the physics concepts being illustrated. Then work with the student to correct any misconceptions or elaborate the information.

The final animation will help you assess their understanding of the physics concepts, as well as their ability to communicate information using multimedia.

#### Resources

Physics in Sports Connection  
[http://archive.ncsa.illinois.edu/Cyberia/VideoTestbed/Projects/NewPhysics/page\\_1.html](http://archive.ncsa.illinois.edu/Cyberia/VideoTestbed/Projects/NewPhysics/page_1.html)

Physics in Sports Simulations  
[http://www.physicscurriculum.com/physics\\_of\\_sports.htm](http://www.physicscurriculum.com/physics_of_sports.htm)

Goodstein, Madeline. *Sports Science Projects: The Physics of Balls in Motion* (Science Fair Success)

Vizard, Frank (Editor). *Why a Curveball Curves: The Incredible Science of Sports* (Popular Mechanics)

#### Standards

##### NSES Content Standard B: MOTIONS AND FORCES

- The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.
- An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.
- If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object’s motion.

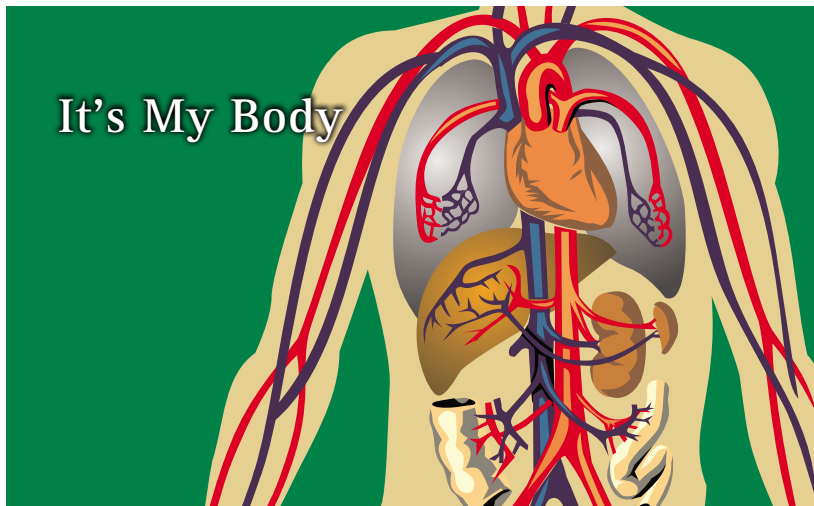
##### NETS for Students:

###### 1. Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

###### 4. Critical Thinking, Problem Solving, and Decision Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.



## Identifiers

### Grade Level

4–5

### Subject

Science, Language Arts

### Duration

2 weeks

### Objective

Students will learn about the systems of the human body.

### Description

Students will create a public service web site that informs the public about a system in the body. The service announcement will discuss the functions of the body and stress the importance of taking care of your body.

### Applications

Share™

## Process

### Authentic Task

The local museum has selected your class to create an interactive student exhibit where students can come and learn about each part of the human body, including the nervous system, respiratory system, circulatory system, and digestive system. Your team's task is to create a web site to inform other students about the importance and function of one of these body systems.

## Engage

### Step 1: Introduction

Ask students how many of them have a bike. Ask students to name the parts of the bike, such as handlebars, seat, and wheels. Record students' answers on chart paper. Ask students to think about how the parts of a bike work together to help you create movement. For example, if one part of the bike is not working, is it still possible that bike will work? Will the bike work as efficiently? Continue to write students' responses on chart paper.

Ask students whether the bike would still work properly if they didn't treat it properly. Discuss with students that each part of the bicycle plays an important function in making the bike work as a whole.

Ask students to think about how the organs in a body system, such as the digestive system, work together. Hold up an apple and take a bite. Ask students what body system you are using to eat the apple. Record students' answers on chart paper. Ask students how each part of the digestive system works together to help digest the apple.

Ask students how the bicycle system is analogous to the digestive system in the human body.

### Step 2: Research

Divide students into small groups and assign each group one of the six body systems:

1. Digestive
2. Circulatory
3. Respiratory
4. Skeletal
5. Muscular
6. Nervous System

The group can use online and print resources to answer the following questions about its body system.

1. What is the name of your body system?
2. Where is the system located?
3. What is the role of the system?
4. What organs make up this body system?
5. What are the main functions of this human body system?
6. What is each organ's function in the body system?
7. How do the organs perform these functions?

## Create

### Step 3: Create a Diagram

Have students work together to create a diagram of their body system using the drawing tools in Share. The diagram, or illustration, should include major organs, correct terminology in the labeling, and a brief text description of how each part contributes to the system's role in the human body.

### Step 4: Create a Body System Web Site

Students should use the information from their research and their diagrams to help them create a web site about the body system.

You might suggest that their web site include:

**Title Page:** Name of the body system

**Page 2:** Function—

What is the role of your system?

**Page 3:** Problems and Diseases—  
What problems can occur?

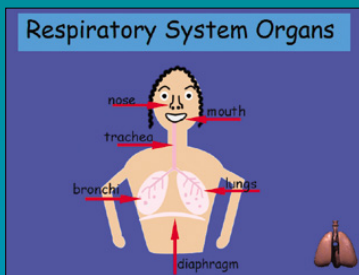


## Steps for Students

### Creating a Web Site in Share™

Once you have created your illustrations and done your research, you can use Share to combine it all together.

1. Launch Share.
2. You will see the first page in your Web site.
3. Click the Text tool on the tool palette. Double-click the text box to add a title.
4. Type the title of your Body System.
5. Change the text format by using the font options on the Options panel.
6. Click the page outside of the text box.
7. You will see the Fill options on the Options panel. Click the color box to choose a color for the page.
8. Click the Library tab to insert an image.
9. Click the Library tab. Double-click the Buttons folder.
10. Double-click a folder, choose the type of button you want to use, or customize your own. Click and drag a home button from the library onto your page.
11. Click the New Page button on the Tool Palette.
12. Repeat steps 3–11 for each page.
13. Use the library to choose additional buttons to complete the navigation.
14. Click the Save button on the toolbar. Choose where you want to save your web site and click Save.
15. To test the navigation of your web site, click the Show button on the tool palette.
16. When you are satisfied that your web site is complete, click the Publish button and choose HTML.
17. To view your web site, find the place where you saved it and double-click the index.html file.



What diseases are associated with your system?

**Page 4: Staying Healthy—**  
What can people do to keep this system healthy?

Why is this system important for good health?

**Page 5: Author's names and bibliography**

## Share

Invite community members, parents, and students to a Human Body Open House. During this open house, various student groups will present their projects on the human body and answer questions from the audience about their projects. The presentation should include a detailed explanation of the human body system, as well as why taking care of the system is important for good health.

## Assessment

Assess your students' prior knowledge based on the introductory bike activity as well as their class participation. You will be able to assess their research abilities and knowledge through their research questions, and you can evaluate comprehension using the diagram they create of the body system. Their web site will help you evaluate writing skills, creativity, and design skills. You will also be able to assess their problem-solving, team work, planning, and time management skills as each team works through the process.

## Resources

Cole, Joanna and Degan, Bruce. *The Magic School Bus: Inside the Human Body*. ISBN: 0590726331

Weiner, Esther. *The Incredible Human Body*. ISBN: 0590599283

Human Anatomy Online  
[www.innerbody.com/htm/body.html](http://www.innerbody.com/htm/body.html)

Virtual Body  
[www.medtropolis.com/vbody.asp](http://www.medtropolis.com/vbody.asp)

## Standards

**Common Core Anchor Standards for English Language Arts - Grade 4-5 Writing Standards**

*Production and Distribution of Writing*

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

*Research to Build and Present Knowledge*

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

**Language Standards**

*Conventions of Standard English*

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

*Knowledge of Language*

3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

**NETS for Students—2007**

**1. Creativity and Innovation**

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. **Students:**

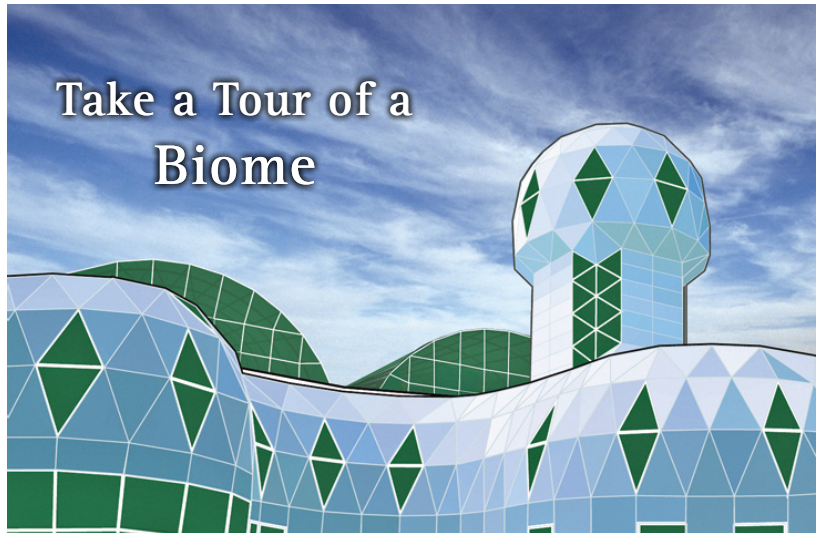
- b. create original works as a means of personal or group expression.
- c. use models and simulations to explore complex systems and issues.

**2. Communication and Collaboration**

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

**Students:**

- b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.



### Identifiers

#### Grade Level

4-6

#### Subject

Language Arts, Science

#### Duration

1 week

#### Objective

Students learn about the five biomes: aquatic, desert, forest, grassland, and tundra.

#### Description

Students will use online resources to investigate one of the five biomes and use Share to create a travel web site of a trip to that biome.

#### Application

Share®

### Process

#### Authentic Task

Airline prices have been dropping lately, causing people to take more vacations. The owner of Journey4Less, a local travel agency, wants to offer special biome vacation packages. The owner has asked for your help to create an informational web site for a vacation to one of the biomes.

### Engage

#### Step 1: Introduction

Complete a Biomes KWHL chart as a class to get students thinking about biomes that exist around the world, activate prior knowledge, and assess what students already know about biomes. Then, using online resources, introduce students to the different biomes. If you have access to the unitedstreaming movie library, you may also want to show a movie about the biomes.

Once students have a strong understanding about biomes, group students into teams of 3-4. Assign each team the task of creating a travel web site for a tour through a different biome.

#### Step 2: Online Research

Have student teams research the following questions about their biome:

1. Where does the biome exist?
2. What plants and animals live in the biome?
3. What is the climate like in the biome?
4. What food chains exist in the biome?
5. What landforms exist in the biome?
6. What places of interest are found in this biome?
7. What makes this biome interesting to visit?

### Create

#### Step 3: Project Work

Students will use Share as a web authoring tool to create a web site advertising a tour of their biome. Students should use the biomes category in Pics4Learning as a resource for adding pictures to their project. The biome web site created in Share must include:

1. A map of where this biome exists.
2. Landforms that exist in the biome.
3. Student-drawn pictures.
4. Information about the biome's climate.
5. Examples of food chains which exist within the biome.
6. What places should a visitor be sure to see?
7. Information about why people should visit your biome.

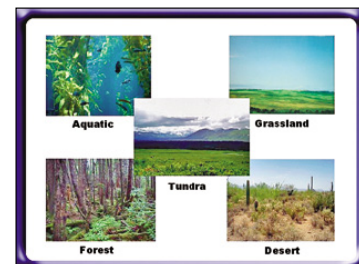
Students can use a storyboard to organize their ideas before creating their web site.

Students should build their information into a Share project. Then, publish the project as HTML or an interactive PDF.

### Share

#### Step 4: Present the Project

Have the students present their tours to parents and community members to encourage them to take their vacations in a specific biome!





### Steps for Students

#### Market Your Tour in Share™

When your tour itinerary is complete, use Share to create the marketing web site. Make sure that the site has a title page, navigation, interesting backgrounds, as well as text that provides information about your biome.

1. Launch Share.
2. Click the Text tool on the Tool Palette. Add a title to your first page.
3. Click the New Page button on the Tool Palette to add more pages.
4. Click the Library tab to add graphics to a page.
5. In the Library, you can add graphics from the Clip Art or Pics4Learning library or click the Browse Files button to add an image you have painted, taken with a digital camera, or downloaded from online.
6. In the Buttons folder in the Library tab choose a navigational button to add to the page.
7. Go to the Library tab and choose to add sounds, movies, and other actions to your tour.
8. Go to the File menu and choose Save As. Use the Save in/Where pull-down menu to choose a place to save the file, type a name in the File Name/Save as field, and click the Save button.
9. Click the Publish button on the Tool Palette, choose HTML. Use the Save in/Where pull-down menu to choose a place to save the web page, give the file a name in the File Name/Save as field, and click the Save button.

### Assessment

The students will research their biome of choice for their web site.

The students will synthesize their knowledge based upon their online research to create the informational web site. This web site must include various facts about the particular biome, including a persuasive argument as to why tourists should visit their biome.

### Resources

Whitfield, Philip and Moore, Peter, Cox, Barry. (2003) **Biomes and Habitats**. Macmillan. ISBN: 0028656334.

Johnson, Rebecca and Saroff Phyllis. (2001) **A Walk in the Tundra (Biomes of North America)**. Carolrhoda Books. ISBN: 1575055260 .

Kalman, Bobbie. (1998) **What is a Biome?** Crabtree Publishing. ISBN: 086505875X .

Lindeen, Carol and Smith-Saunders Gail. (2003) **Life in a Desert (Pebble Plus: Living in a Biome)**. Capstone Press. ISBN: 0736833994.

World Biomes  
[www.ucmp.berkeley.edu/glossary/gloss5/biome/](http://www.ucmp.berkeley.edu/glossary/gloss5/biome/)

Mission: Biomes  
[earthobservatory.nasa.gov/Laboratory/Biome/](http://earthobservatory.nasa.gov/Laboratory/Biome/)

### Standards

#### NSES-National Science Standards CONTENT STANDARD C

As a result of their activities in grades 5-8, all students should develop understanding of:

- Structure and function in living systems
- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

#### CONTENT STANDARD C

As a result of activities in grades K-4, all students should develop understanding of:

- The characteristics of organisms
- Life cycles of organisms
- Organisms and environments

#### Common Core Anchor Standards for English Language Arts - K-5 Writing

*Research to Build and Present Knowledge*

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

#### Speaking and Listening

*Comprehension and Collaboration*

2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

*Presentation of Knowledge and Ideas*

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

#### NETS 3-5 Performance Standards:

1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively. (1)

4. Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. (3)

5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom. (3, 4)



## Identifiers

### Grade Level

5–8

### Subject

Language Arts, Science,  
Social Studies

### Duration

2 weeks

### Objective

Students will write persuasively on a conservation issue.

### Description

Students will create a public service announcement for a conservation issue they feel strongly about. They will write a persuasive essay and transform this argument into a public service announcement using Frames.

### Application

Frames™

## Process

### Authentic Task

The Earth needs your help! While pollution has decreased in many places, we are still releasing tons of toxins into the air and water every day. Access to clean drinking water is decreasing, and landfills are filling up quickly. One and one-half acres of rainforest are lost every second.

Balancing the demands of a growing population, a high standard of living, and

a healthy environment is a delicate and difficult process. Using their incredible powers of persuasion, and the techniques of persuasive writing, have students craft a public service announcement that educates citizens on environmental issues. They should make their announcement powerful enough to persuade people to change their behavior to lessen a negative impact or increase a positive impact on the environment.

### Engage

As a class, brainstorm a list of things worth conserving. You may want to focus on a threatened area, like the rainforest, or look for problems your students can solve in their own communities, like waste reduction or clean water.

Have individual students choose an issue that is important to them and formulate a thesis or debatable statement about the issue. Have them research information about the issue and then review and organize their materials. Since facts are a great way to support a compelling argument, students may want to organize their facts using a fact vs. opinion graphic organizer. Students also need to determine which research information supports their argument and which information contradicts it. Once they have identified arguments against their thesis, have them develop counter arguments they can incorporate into their essays.

Students should now write a first draft of the essay, trying to get all their ideas down in logical order. When the first draft is finished, have them print and edit their work, making changes to improve the essay. This would be a great time to have students review one another's work.

Share examples of public service announcements you find on television or online.

Which ones do the students like? Why?

Which ones make the most compelling arguments? Why?

Most public service announcements are between 10 and 60 seconds long. Ask students how much of their essay they can they read in ten seconds. How are they going to need to think differently to make their argument in a PSA? Work as a class to brainstorm nonverbal strategies for making a compelling PSA.

### Create

Let students know they will be working on a team with other students exploring their issue to create a 30-second public service announcement. Group the students together and have them begin their work by reading their arguments to the rest of their team members.

Working as a team, ask students to identify the best arguments in each essay and brainstorm how they could share those ideas in a short PSA. Have them list the stories, facts, and ideas they think will be helpful in making an argument in their public service announcement.

Have each team complete a vision for their project to define their argument, identify their audience, refine their goal, and choose an idea to pursue. Each team should then refine their vision and begin developing a storyboard to serve as the map for the PSA design.



### Steps for Students

#### Creating PSAs in Frames™

Students begin building their PSA by gathering the media resources needed. They may want to use a digital camera or Pics4Learning to gather images for their PSAs.

1. Launch Frames.
2. Click the New blank frame button on the toolbar to add more frames.
3. Click the Library button to add clip art, photos, or images you have collected.
4. Click the Tools button to use drawing tools to create your own illustrations.
5. Click the Clone button on the toolbar to duplicate frames. Make changes to the objects on the frames to create animation.
6. Click the Text tool on the Tools panel to add text. Use the handles and Format options to change how the text looks.
7. Click the Record tool on the Tools panel to add narration.
8. Select a frame or group of frames and adjust the Duration slider on the Tools panel to change the timing.
9. Click the Save button on the toolbar to save the file.
10. Click the Project button and choose *Export* to create an animated movie to share.



Teams should begin by gathering the media resources needed for their PSA. Teams may choose to work on each stage of the development process together or assign roles, such as researcher, editor, graphic artist, and director, to divide up the tasks. Have students use the tools in Frames to develop their PSA.

#### Share

Have teams share their PSAs with the class while talking about the collaborative process it took to create the PSA. You might choose to share the PSAs on your school web site, or present them during morning announcements. You may also be to share the PSAs with your local access television station to help educate the community.

#### Assessment

The fact vs. opinion organizer, vision, and storyboard will give insight to the direction teams are heading with their project. Assessing these items and observing the collaborative process before students begin working in Frames may help ensure the successful completion of the PSA. You may want to have students keep a project journal or write daily reflections, as it will be impossible to hear every student's comments during the process. The final PSA will help you assess their understanding of the issue as well as their ability to persuade viewers using multimedia.

#### Resources

Chiras, Daniel D., John P. Reganold, and Oliver S. Owen. *Natural Resource Conservation: Management for a Sustainable Future*  
ISBN: 0130333980

Botkin, Daniel B. and Edward A. Keller. *Environmental Science: Earth as a Living Planet*  
ISBN: 0471389145

Daily, Gretchen C. *Nature's Services: Societal Dependence on Natural Ecosystems*.  
ISBN: 1559634766

#### Standards

##### Common Core Anchor Standards for English Language Arts - Grade 5-12 Writing Standards

###### Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

###### Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others

##### Speaking and Listening Standards

###### Presentation of Knowledge and Ideas

5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

##### NSES - National Science Education Standards

CONTENT STANDARD F: As a result of activities in grades 5 - 8 , all students should develop understanding of:

- Personal health
- Populations, resources, and environments
- Natural hazards
- Risks and benefits
- Science and technology in society





### Identifiers

#### Grade Level

3-6

#### Subject

Language Arts, Social Studies

#### Duration

1 week

#### Objective

Students will develop a clear understanding about the different rainforest regions found around the world through research and the creation of rainforest postcards.

#### Description

Students will learn about various rainforest regions through an online research project. They will use ImageBlender to create postcards which will show the plants and animals indigenous to a particular rainforest region.

#### Application

ImageBlender™

### Process

#### Introduction

Students will develop a clear understanding about the different rainforest regions found around the world through research and the creation of rainforest postcards.

#### Engage

Begin by reading the book *The Kapok Tree* by Lynne Cherry. This is a story of a young man in the Amazon rainforest who has been told to cut down the Kapok Tree. However, he grows tired and falls asleep. While the young man is sleeping at the base of the tree, he dreams about many animals who beg him not to cut down the tree. In the end, the man does not cut the tree down.

Before students begin their research, lead a discussion about biomes. You can use a KWL chart to stimulate discussion about the different biomes, and the rainforest biome in particular.

Once the students have a clear understanding of what a biome is and can define characteristics of the rainforest biome, let them know that they are going on an expedition to one of five rainforests around the world.

The students are responsible for creating informational postcards throughout their rainforest expedition. Upon their return from the expedition, the entire class will compare and contrast the different rainforest areas.

Divide the students into five equal teams. Each team will be responsible for one of the following rainforest regions:

1. Central American
2. Amazon
3. Congo River Basin
4. Madagascar
5. Southeast Asia

Students should complete research about their rainforest region. Using information from their research, students should be able to answer:

1. What types of plants are found in this rainforest region? Are these plants unique to this region?
2. What types of animals are found in this rainforest region? Are these animals unique to this region?
3. What is the weather in this rainforest region?
4. Who lives in this rainforest region?

#### Create

Once the students have completed their research, they will use ImageBlender to create the postcards from their rainforest region. Each ImageBlender page will be a synopsis postcard of what the group “saw” that day. Each team member will complete at least one postcard.

Even though students are working individually on a postcard, they need to decide as a team what information will be covered, so that the entire group’s postcards are a summary of that rainforest region. Have the students use a storyboard to plan out their postcards and decide which team member will create each postcard.

As a set, the postcards should contain information about the following:

1. Plants and animals found in the rainforest.
2. Weather in the rainforest.
3. People who live in the rainforest.
4. Things that make the rainforest unique.

Each postcard should include text and a photograph or illustration depicting what the expedition saw that day. Students can find pictures of rainforest species at [Pics4Learning](#) or use the ImageBlender



### Steps for Students

#### Creating a Postcard in ImageBlender™

1. Open ImageBlender.
2. Click the New button on the toolbar. You will see the New Image dialog.
3. Use the Units pull-down menu to choose inches. Change the width to 6 and the height to 4 to make a postcard sized canvas. Click the OK button. You will see a blank canvas.
4. Use the Paint tools to paint illustrations on your postcard. Adjust the brush color using the color palette and the brush size and shape using the options in the panel on the right
5. To add images to your postcard, click the Add Image as a Layer button at the bottom of the tool palette. Use the From File option to locate an image on your computer or network.
6. To add more images to your postcard, click the Add Image as a Layer button and use the From Pics4Learning option to find an image from the Pics4Learning collection. You can even search for rainforest!
7. Click the Text tool on the tool palette. You will see a text box.
8. Drag it to the place you want it on the postcard and type information inside the text box about the rainforest.
9. Click the Print button on the toolbar to print a copy of your postcard.
10. Click the Save button on the toolbar to save your work to your team's folder.
11. Click the New button on the toolbar to create the back of the postcard. Make the Canvas size the same and use the Text tool to add a description of what you saw that day in the rainforest.
12. Use the toolbar buttons to save and print the back of your postcard.



paint tools to create original artwork.

#### Share

Have the Central American rainforest expedition and the Amazon rainforest expedition share their postcard web sites.

As a whole class, compare the Central American rainforest to the Amazon rainforest. Use a two circle Venn diagram to determine the similarities and differences between these rainforests. Next, have the Congo River Basin rainforest expedition, the Madagascar rainforest expedition, and the Southeast Asia rainforest expedition share their postcard web sites.

As a whole class, compare the three rainforests. Use the three circle Venn diagram to determine the similarities and differences between these rainforests.

#### Assessment

After reading the Great Kapok Tree, ask students to respond to the literature. For example, how important was the Kapok tree and to whom?

When students are completing research about their region, assess their answers to the research questions to make sure they can tell you what plants and animals are found in this region as well as what makes this region unique from other rainforest regions around the world.

To get the students thinking about the environment, ask them to brainstorm other examples where our ecosystem is in danger. You will also be able to assess some of the students' basic knowledge about the rainforest.

You will be able to assess student comprehension after the project as you use Venn diagrams to compare the various rainforests.

#### Resources

Cherry, Lynne. (2000) **The Great Kapok Tree**. Voyager Books. ISBN: 0152018182

Rainforest Education  
[www.rainforesteducation.com/](http://www.rainforesteducation.com/)

Rainforest Facts  
[www.rain-tree.com/facts.htm](http://www.rain-tree.com/facts.htm)

Animals of the Rainforest  
[www.animalsoftherainforest.com/](http://www.animalsoftherainforest.com/)

#### Standards

##### NSES-National Science Education Standards

##### CONTENT STANDARD C:

As a result of activities in grades K-4, all students should develop understanding of:

- The characteristics of organisms
- Life cycles of organisms and environments

##### NETS 3-5 Performance Standards:

4. Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. (3)

5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom. (3, 4)

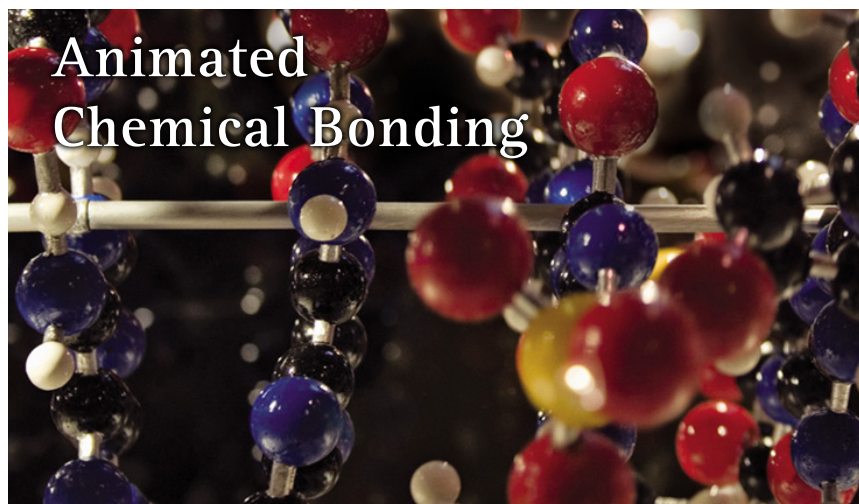
9. Determine which technology is useful and select the appropriate tool(s) and technology resources to address a variety of tasks and problems. (5, 6)

##### Common Core Anchor Standards for English Language Arts - Grade 3-6

##### Writing Standards

*Research to Build and Present Knowledge*

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.



# Animated Chemical Bonding

## Identifiers

### Grade Level

8–11

### Subject

Science

### Duration

3 class periods

### Objective

Students demonstrate understanding of a chemical process.

### Description

Students create a clay animation that demonstrates how a specific type of chemical bond (ionic, covalent, or metallic) is formed.

### Application

Clay Animation Kit and Frames™

## Process

### Introduction

Now that you have studied the different types of chemical bonds (ionic, covalent, and metallic), create a clay animation model that will help the students in next year's course understand how valence shell electrons affect the types of bonds that different elements make.

### Engage

This project is a great summative assessment after you have introduced and explained the various types of chemical bonding.

#### Step 1: Study How Chemical Bonds Form

Chemistry deals with concepts at a molecular or atomic level, making students think abstractly or conceptually. In chemistry courses, you complete experiments and create concrete models that demonstrate what is happening at a molecular level to help students understand these concepts. Having them create clay animations to demonstrate processes and models also helps make these concepts tangible.

This project is a culminating activity to reinforce and remind students of concepts you have covered. So, before they begin working on a clay animation, cover, and UNcover, important chemistry concepts through reading, models, lab work, and discussions.

Before creating animations that demonstrate chemical bonding, students must be familiar with how chemical bonds form. Share examples of the various types of bonds: ionic, covalent, and metallic. Ionic bonding involves the transfer of electrons, covalent bonding involves sharing of electrons, and metallic bonding can be considered a combination of both.

Chemical bonds form to lower the energy of the system. Each component of a system becomes more stable by forming a bond. A full valence shell equals stability.

Students should be able to explain how the valence shell of electrons affects the type of bonding between elements and how compounds bond because of electrostatic charge.

### Create

#### Step 2: Define and Design a Bond Model

Have students form into small teams.

Assign each team a type of bond to model.

Have each team develop their own definition for their bond. Have them brainstorm at least five examples of elements or compounds that form this type of bond.

Have students create a visual model of the bond. The model should also include a description of the bond and a justification for the elements they chose to demonstrate the bond. Evaluate the model for accuracy. Have students make necessary changes.

#### Step 3: Plan and Build a Bonding Animation

Once the model is complete, have students use a storyboard to map out how their animation will demonstrate the chemical bond. The team should write and develop a narrative script to explain how the bond is made in this example, and share other examples of where this type of bond can be found.

Have each team create a clay animation simulation of their chemical bond. The animations should contain models of each atom/element showing protons, neutrons, and electrons and their charges. Models should also demonstrate how these charges and structures contribute to the type of bond this element makes.

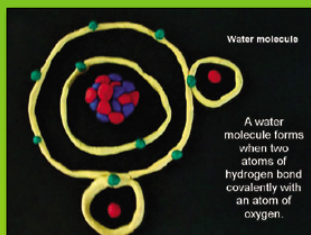


### Steps for Students

#### Creating an Animation in Frames™

Once you have all of your images collected, use Frames to animate a chemical bond.

1. Connect your camera to the computer.
2. Launch Frames.
3. Click the **Library** button to navigate to the camera and import the frames you have captured.
4. Click and drag the pictures in the storyboard to change the order.
5. Click the **New blank frame** button on the toolbar to add more frames.
6. Click the **Text** tool on the Tools panel to add text. Use the handles and Format options to change how the text looks.
7. Click the **Record** tool on the Tools panel to add narration.
8. Select a frame or group of frames and adjust the Duration slider on the Tools panel to change the timing.
9. Click the **Save** button on the toolbar to save changes.
10. Click the **Project** button and choose Export to create an animated movie to share.



### Create

#### Step 4: Share the Animations

Have the students share their clay animations with the rest of the class. Use this as a review before an exam. You might also want to share them with a local access television station and other chemistry classes in your area.

#### Modifications

Before students can truly understand bonding, which requires knowledge of valence shells and electrons, they must understand the Periodic Table and what makes each element unique. Have each student in your class create a clay model of an element and animate it to demonstrate the valence shells and electrons.

Apply the clay animation process to other chemistry concepts such as electrostatic charge or micelles. You may even want to create a new television series about chemistry concepts to help new chemistry students visualize the concepts more clearly; however, remember that creating the animation is more learning intensive than watching it.

### Assessment

The introductory activities, including discussions, reading, and lab work, will build a foundation of knowledge appropriate for students to create the animation.

As the teams work, be sure to evaluate their initial model. Their description of how the bond works will provide insight into their thinking. Ask questions to test their knowledge about the bond. Be sure to ask why they chose the elements or molecules used in the model.

The storyboard is a clue into how well students can verbalize and visualize the chemical bond for someone else. The animation is a culmination of their model, storyboard, planning, and teamwork. Students' ability to answer peer questions after showing their animation will indicate comfort and fluency with the concept.

### Resources

Winter, Mark J. **Chemical Bonding**. (Oxford Chemistry Primers, No 15). ISBN: 0198556942

ChemWeb Online (a ThinkQuest entry) [library.thinkquest.org/19957/](http://library.thinkquest.org/19957/)

Periodic Table of the Elements [periodic.lanl.gov](http://periodic.lanl.gov)

An Introduction to Chemical Bonding [www.newi.ac.uk/buckleyc/bonding.htm](http://www.newi.ac.uk/buckleyc/bonding.htm)

### Standards

#### NSEA–National Science Education Standards

As a result of their activities in grades 9–12, all students should develop an understanding of the structure of atoms, the structure and properties of matter, and chemical reactions. (Physical Science–CONTENT STANDARD B)

#### NETS for Students–2007

##### 1. Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

- a. apply existing knowledge to generate new ideas, products, or processes.
- b. create original works as a means of personal or group expression.
- c. use models and simulations to explore complex systems and issues.
- d. identify trends and forecast possibilities.



#### Get More!

Find more lessons, templates, samples, and rubrics at:

[www.recipes4success.com/lessons](http://www.recipes4success.com/lessons)