Lesson Plan – Martha Rogers – 3rd Grade

Tohono O'odham Nation – Sells, AZ

Santa Rosa Day School

Format :	**One Unit. Two (2) Activities** **Two (2) Hands-on Lab Lessons**
Time Frame:	**One school quarter (October to January)**
Time Allocated for Science:	**Two hours twice a week**
Cultural Connections	**Native American Stories:** **Tohono O'odham Legend: "The Story of the Wind and the Rain"** **Tohono O'odham -Dr. Ofelia Zepeda's Poem "Smoke in our Hair"** **Pima Legend – Why Coyote isn't Blue?**

Science 3rd Grade Standards

Strand 1: Inquiry Process

Concept 1: Observations, Questions, and Hypotheses

Observe, ask questions, and make predictions.

-PO1. Formulate relevant questions about the properties of objects, organisms, and events of and events of the environment using observations and prior knowledge.
-PO2. Predict the results of an investigation based on observed patterns, not random guessing.

Concept 2: Scientific Testing (Investigating and Modeling)

Participate in planning and conducting investigations and recording data.

-PO1. Demonstrate safe behavior and appropriate procedures (e.g., use instruments, materials, organism) in all science inquiry.
-PO4. Use metric and US customary units to measure objects.
-PO5. Record data in an organized and appropriate format (e.g., t-chart, table, list, written log).

Strand 3: Science in Personal and Social Perspectives

Concept 2: Science and Technology in Society

Understand the impact of technology.

-PO 1. Identify ways that people use tools and techniques to solve problems.
-PO 2. Describe the development of different technologies (e.g., communication, entertainment, transportation, medicine) in response to resources, needs, and values.
-PO 3. Design and construct a technological solution to a common problem or need using common materials.

Strand 5: Physical Science

Concept 3: Investigate different forms of energy

-PO1. Demonstrate that light can be:
reflected, refracted, and absorbed by dark surfaces.
-PO2. Describe how light behaves on striking objects that are transparent, translucent, and opaque.

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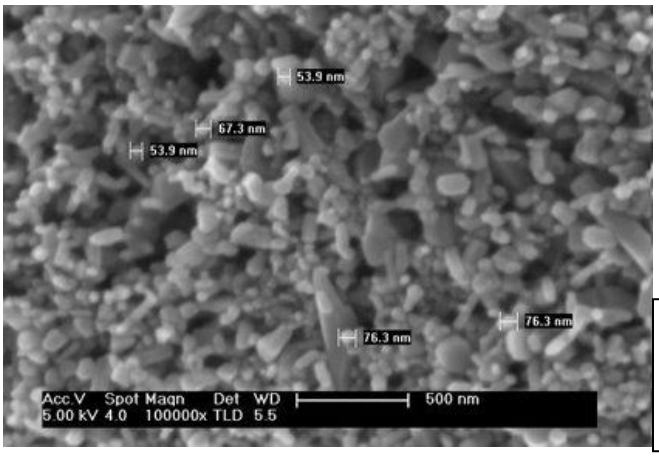
Teacher will follow the mandatory Santa Rosa School – Science Curriculum – Arizona Science Harcourt School Publisher 2006. Cultural Connections will be integrated. Student Science Journals for Reflection.

Objectives

Students will:

- Understand the meaning of "nano"
- Understand that a nanometer is an extremely small unit of measure (think small)
- Understand that nanoscale materials and effects are found all around us in nature
- Compare the relative size of different body parts and microorganisms using the metric system from meter to nanometer
- Understand that at the "nano" level, things behave differently, and how scientists use this behavior to make new technologies
- Understand nanotechnology applications

Common Core Standards: Depth of Knowledge (DOK) and modified Bloom's Taxonomy: Level 1 (Recall), Level 2 (Skill/Concept), Level 3 (Strategic Thinking), Level 4 (Extended Thinking)



What is a nanometer?
One nanometer is a billionth of a meter.

A nanometer is a millionth of a millimeter.
www.whatisnano.org
Nisenet

www.google.com/images
santanu's research –sansin75
A microscope image of nanoparticles (note the scale)

Rationale:

Students will draw conclusions about how nanotechnology has revolutionized and will impact the future of science and engineering. Nanotechnology is an emerging field of science and students need to realize at a young age that nanoscale materials and their effects are found all around them in nature. Students will gain an understanding of how nanoscientists are studying this field, and how they are making it possible for us to see

incredibly small things at the nanoscale with special microscopes. In addition, nanoscientists are creating tiny little devices and materials that are at the nanoscale. This new nanotechnology is impacting our daily lives with great benefits. However, nanoscientists are considering the risks too.

Lesson 1

Materials:

YouTube Video: How Small is a Nano? NiseNet (National Nanotechnology Initiative)
Website: http://www.whatisnano.org
Website: http://www.nanotech-now.com
Website: www.nano.gov
Teacher created worksheet # 1 – Comparing different objects by their size from the meter to the nanoscale and detection devices (enclosed worksheet). O'odham Language is integrated.
Teacher created assessments # 1- Anticipatory Guide
Smartboard, LCD Projector, Document Camera
SEM and TEM Images of cells, virus, and nanoparticles (not copyrighted)
Scale of the Universe Website: http://htwins.net/scale2/

Activities

Students will be given an anticipatory test as a pre-test and post-test (enclosed assessment).

Prerequisite: Students will review and analyze a metric scale so they can compare the difference between objects in metric units.

Cultural Connections:

Tohono O'odham people do not tell their traditional stories during summer. Elders explain that snakes do not like to hear them, and, sometimes, it makes them angry. This causes them to come out and bite the storyteller. Byrd Baylor, *Legends told by Arizona Indian Children* (1998). This unit will be conducted between fall and winter and an Elder (our culture teacher) will be invited to share the story with the students in the O'odham Language, and teacher will read it in English.

Prerequisite: Students will learn about the Scientific Method comparing Western Ways (Global Knowledge) and O'odham Ways of Knowing using the *Story of Wind (Hewel) and the Rain (Juki)*. Adapted by Dr. Teresa Newberry, Tohono O'odham Community College.
Steps: Observation, Question, Literature Review, Hypothesis, Deduction, Test, Conclusion, Peer Review, Comparison of Similarities and Differences. Table 1 (Enclosed)

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Animal Characters: Coyote - Ban; Bear - Judum; Buzzard – Nui; Hummingbird – Wipismel

Similarities	*Differences*
There is a problem to be solved, a question is asked. Hypothesis	The elements are alive.
The process of science	The animals speak and are the scientists
Knowledge is created in increments adding the information produced by scientists one experiment or test at a time.	Knowledge is holistic vs. reductionist. Story includes spiritual and emotional elements such as concepts of respect, balance, relationship, connection, and ethics as well as the physical nature of the world. Science only explores the physical nature of the world.
Rain follows the wind.	Knowledge is recorded orally vs. written.
Conclusion: Life depends on rain or water, the plants and animals die if there is no rain.	

Students will illustrate the Story of Wind (Hewel) and the Rain (Juki) by going through the steps of the Scientific Method since the story itself does not have illustrations. It is presented in a table format. Teacher will check for understanding.

Community Support:

Teacher will notify parents/guardians, Elders what the unit will cover during the school quarter. Teacher will also keep informed our Santa Rosa Day School Elementary Culture Teacher about the instruction taking place in the classroom. The teacher will seek for her cooperation and keep her posted. She will consult with the Culture teacher about other culturally-relevant activities that can be included in the unit.

Student Science Journals:

Students will write on their reflection science journals every time that we finish an activity throughout the entire unit as follows:

I learned……	I wonder….	Wow!

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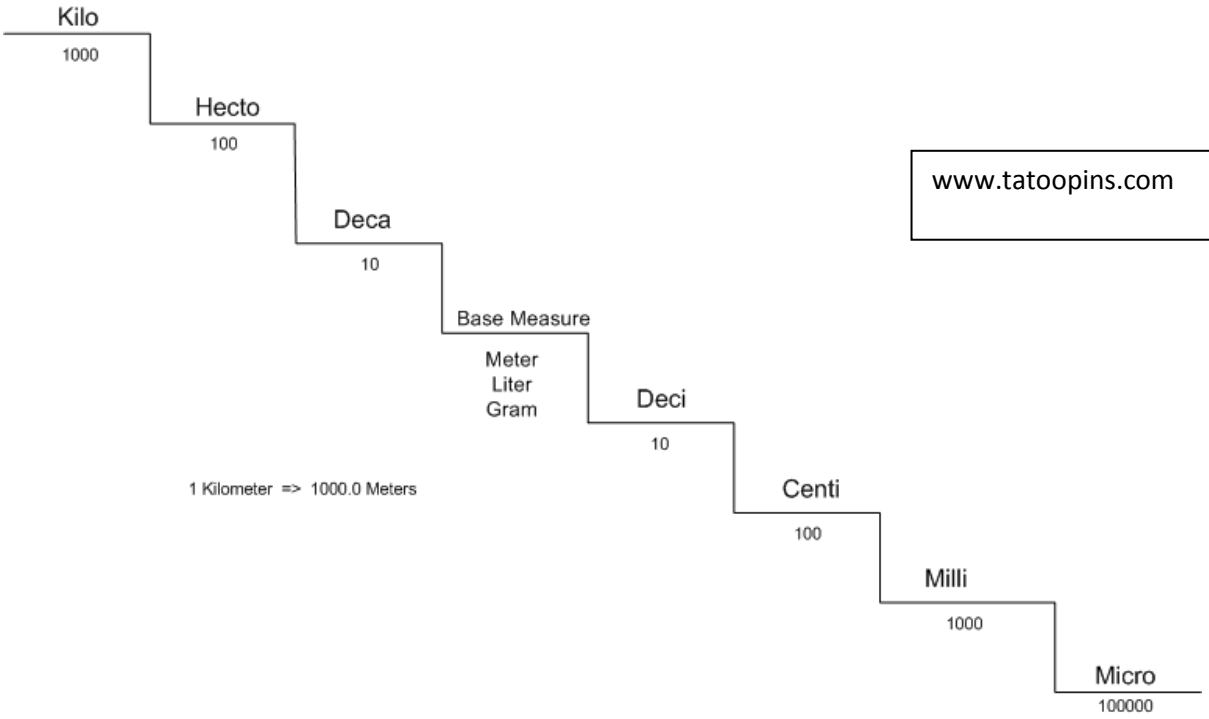
Students will review the metric system from meter to nanometer using this following stair illustration and table.

Prefix	abbreviation	Power of 10	Mass unit	Length unit	Volume unit
*mega-	M	10^6 or 1,000,000	megagram, Mg	megameter, Mm	megaliter, ML
kilo-	k	10^3 or 1000	kilogram, kg	kilometer, km	kiloliter, kL
hecto-	h	10^2 or 100	hectogram, hg	hectometer, hm	hectoliter, hL
deka-	da	10^1 or 10	dekagram, dag	dekameter, dam	dekaliter, daL
base unit	------	10^0 or 1	**gram**	**meter**	**liter**
deci-	d	10^{-1} or 0.1	decigram, dg	decimeter, dm	deciliter, dL
centi-	c	10^{-2} or 0.01	centigram, cg	centimeter, cm	centiliter, cL
milli-	m	10^{-3} or 0.001	milligram, mg	millimeter, mm	milliliter, mL
*micro-	μ	10^{-6} or 0.000001	microgram, μg	micrometer, μm	microliter, μL

*Note that these units are more than a power of 10 difference from the previous units.

www.axsoris.com -



www.tatoopins.com

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1000^m	10^n	Prefix	Symbol	Short scale	Long scale	Decimal
1000^8	10^{24}	yotta-	Y	Septillion	Quadrillion	1 000 000 000 000 000 000 000 000 000
1000^7	10^{21}	zetta-	Z	Sextillion	Trilliard	1 000 000 000 000 000 000 000 000
1000^6	10^{18}	exa-	E	Quintillion	Trillion	1 000 000 000 000 000 000 000
1000^5	10^{15}	peta-	P	Quadrillion	Billiard	1 000 000 000 000 000 000
1000^4	10^{12}	tera-	T	Trillion	Billion	1 000 000 000 000
1000^3	10^9	giga-	G	Billion	Milliard	1 000 000 000
1000^2	10^6	mega-	M	Million		1 000 000
1000^1	10^3	kilo-	k	Thousand		1 000
$1000^{2/3}$	10^2	hecto-	h	Hundred		100
$1000^{1/3}$	10^1	deca-	da	Ten		10
1000^0	10^0	*(none)*	*(none)*	One		1
$1000^{-1/3}$	10^{-1}	deci-	d	Tenth		0.1
$1000^{-2/3}$	10^{-2}	centi-	c	Hundredth		0.01
1000^{-1}	10^{-3}	milli-	m	Thousandth		0.001
1000^{-2}	10^{-6}	micro-	μ	Millionth		0.000 001
1000^{-3}	10^{-9}	nano-	n	Billionth	Milliardth	0.000 000 001
1000^{-4}	10^{-12}	pico-	p	Trillionth	Billionth	0.000 000 000 001
1000^{-5}	10^{-15}	femto-	f	Quadrillionth	Billiardth	0.000 000 000 000 001
1000^{-6}	10^{-18}	atto-	a	Quintillionth	Trillionth	0.000 000 000 000 000 001
1000^{-7}	10^{-21}	zepto-	z	Sextillionth	Trilliardth	0.000 000 000 000 000 000 001
1000^{-8}	10^{-24}	yocto-	y	Septillionth	Quadrillionth	0.000 000 000 000 000 000 000 001

http://www.scoopweb.com/Metric_prefix

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Prerequisite: Students will review and analyze a chart displaying relative sizes and detection devices such as a light microscope, Transmission Electron Microscope (TEM), and Scanning Electron Microscope (SEM).

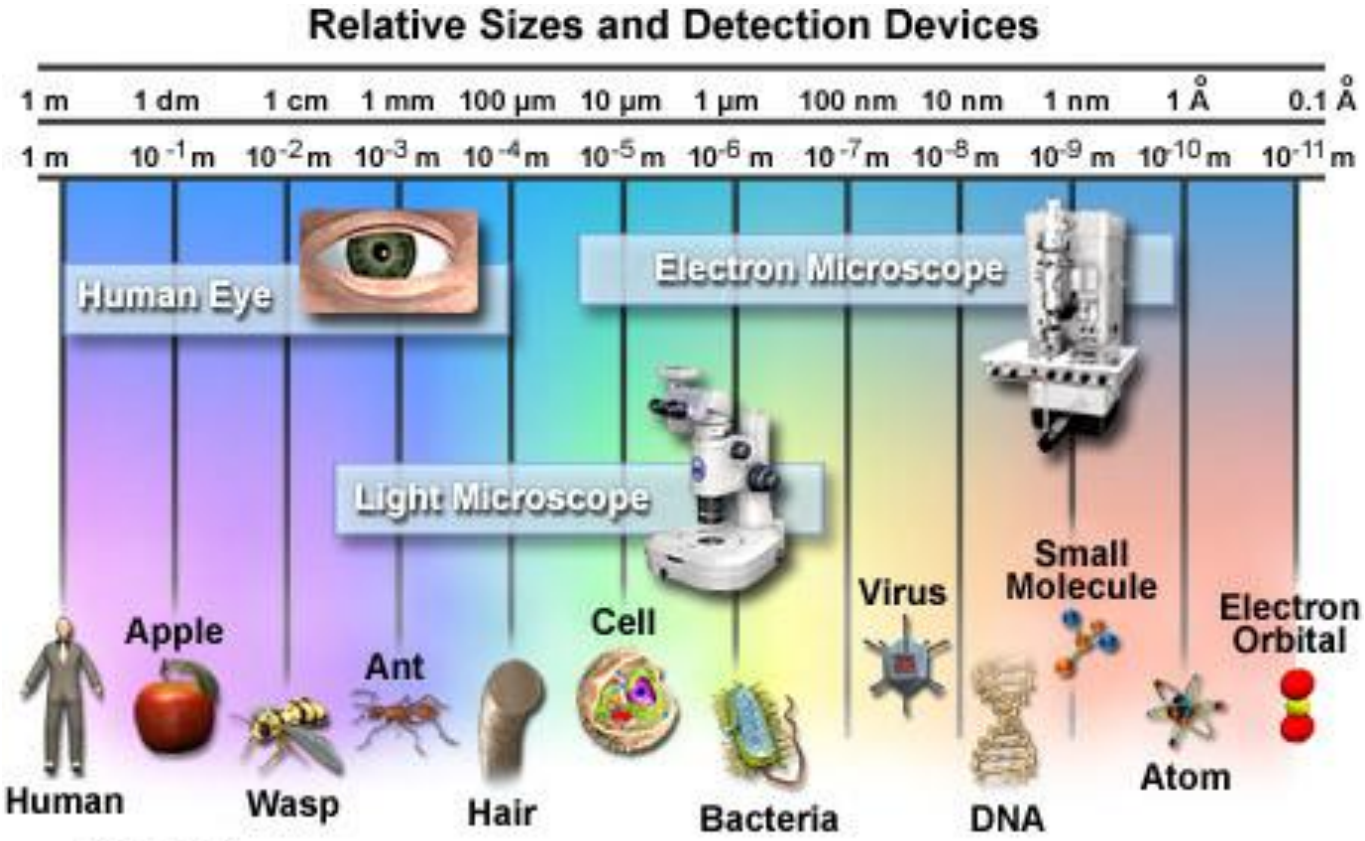

Figure 1

Dr. Dr. Amit Kessel's Homepage

http://amit1b.wordpress.com/the-molecules-of-life/10-the-living-cell-gallery/

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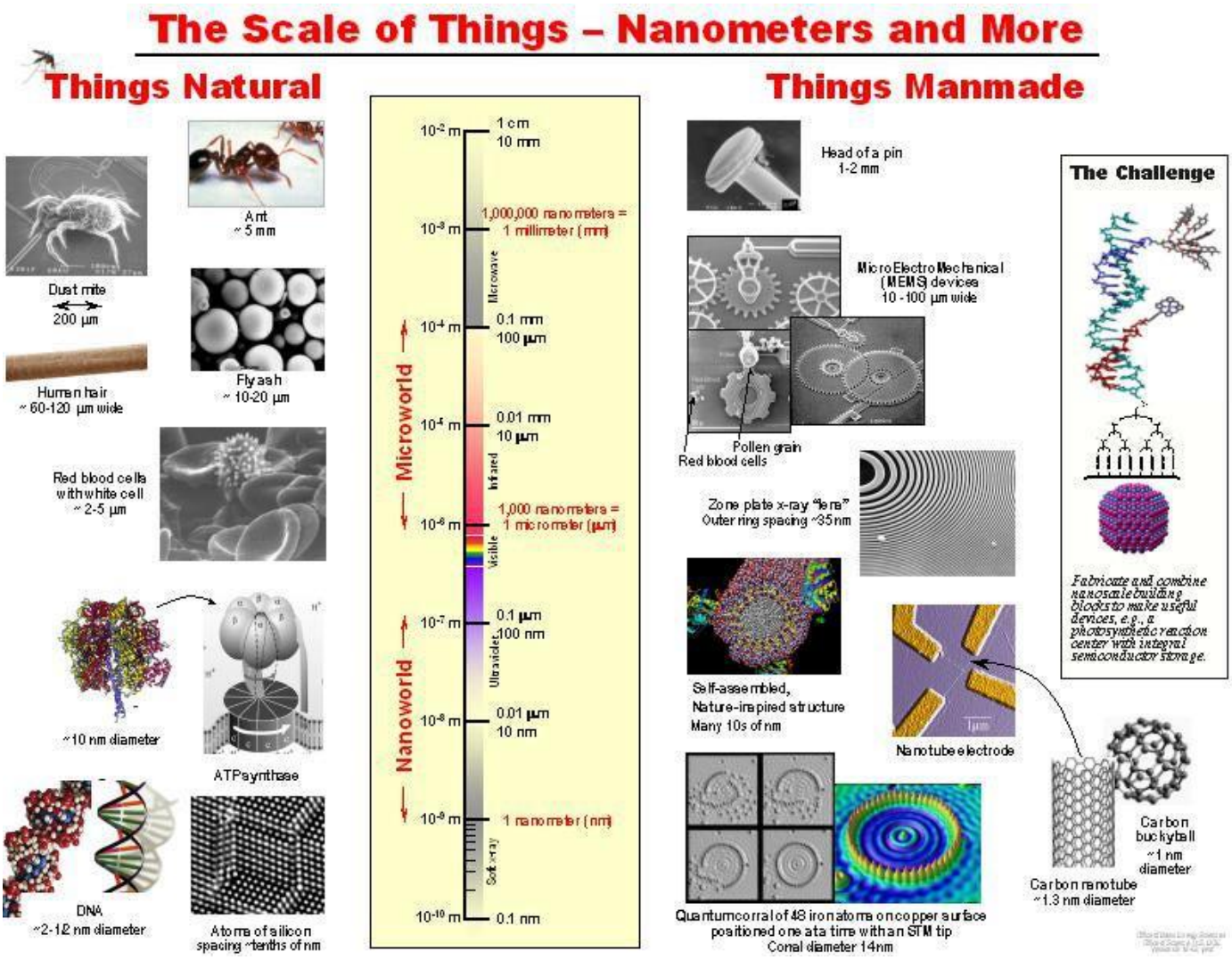
Students will use this chart to compare the scale of things made in nature to things made by humans. Teacher will go over the National Nanotechnology Initiative brochure to view and discuss more examples of man-made things at the "nanoscale."



Nanotechnology – The Nano Scale

http://inventors.about.com/od/sstartinventions/ss/Physics_Illustr_3.htm

Students will go to the computer lab and play with the website - http://htwins.net/scale2/.

Evaluation:

- Students Reflection Science Journals
- Students worksheet # 1 finished,
- Anticipatory Set, Pre-Test and Post Test
- Teacher Reflection about the outcomes
- Feedback from the Culture Teacher

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Lab Work 1

Lesson Plan (http://sites.bergen.org/forensic/Hair Analysis.htm)
modify by Martha Rogers.

Objectives

Students will:

1. Analyze and compare hair strand images obtained using a light microscope to images obtain using aSEM Scanning Electron Microscope (SEM).
2. Understand how small a micrometer is in relation to other measures in the metric system by comparing different hair strands (e.g., human black hair vs. blond hair, dog hair vs. cat hair).
3. Improve skills in observation, critical thinking, and microscopy.

Activities

Prerequisite:

The following explanation of the physical structure of hair is particularly useful as the students examine the hair strands. Hair is composed of three principal parts:

Cuticle – outer coating composed of overlapping scales.
Medulla – central core, which may be absent (coarse hair).
Cortex – protein-rich structure surrounding the medulla; contains pigment.

Video: YouTube- The Structure of Hair. Center for Child Advocacy. Montclair State University.

Cultural Connections:

Smoke in Our Hair, Where Clouds Are Formed, Poems by Dr. Ofelia Zepeda (2008).

Dr. Ofelia Zepeda is a member of the Tohono O'odham Nation of Southern Arizona. She is a Regent's Professor of Linguistics at the University of Arizona in Tucson, AZ. She is the recipient of the MacArthur Fellowship for her work in American Indian Language education and revitalization. In addition, Dr. Zepeda is co-founder and director of The American Indian Language Development Institute (AILDI).
Teacher will ask the school culture teacher to translate the poem, if it is possible, to the O'odham Language.
Why I choose this poem?

Students will:

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1. Be introduced to Dr. Ofelia Zepeda as a role model.
2. Understand the importance of revitalizing the Tohono O'odham language and culture.
3. Compare Western (Global) knowledge to Traditional Knowledge about hair through Dr. Zepeda's Tohono O'odham perspective.
4. Make connections about what it is said in the poem and explain difficult vocabulary, such as the words distinct and ephemeral.
5. Practice O'odham language such as: hair – kushpo; burn – kohathk; smoke – jehjena; mesquite – Kui; bean – wihog; sap – usabi; wood – uhs.
   Questions:
   - What is the author trying to tell us?
   - In the poem there is a simile, what is the hair compare to?
   - What does the first stanza mean? What does the second stanza mean?
   - What is the most cherished memory when you are away from your land and your tribe?
   - Do you know the different types of mesquite trees?
   - Do you know the piñon or cedar trees?
   - What is the theme of this poem?

Smoke In Our Hair, by Dr. Ofelia Zepeda

The scent of burning wood holds
the strongest memory.
Mesquite, cedar, piñon, juniper,
all are distinct.
Mesquite is dry desert air and mild winter.
Cedar and piñon are colder places.
Winter air in our hair is pulled away,
and scent of smoke settles in its place.
We walk around the rest of the day
with the aroma resting on our shoulders.

The sweet smell holds the strongest memory.
We stand around the fire.
The sound of the crackle of wood and spark is ephemeral.
Smoke, like memories, permeates our hair,
our clothing, our layers of skin.
The smoke travels deep
to the seat of memory.
We walk away from the fire;
no matter how far we walk,

we carry this scent with us.
New York City, France, Germany -
we catch the scent of burning wood;
we are brought home.

Materials:

- 4 Light Microscopes (one per each group)
- Microscope slides
- Cover slips
- Hair strands from humans, dogs, and cats
- Water and droppers
-Tweezers
-Lens paper
-Tissue paper
-Small envelopes to classify the hairs strands
-Observation Logs (assessments) (worksheet # 2 and # 3 attached)

Prerequisite: 1. Students will be trained how to use a microscope. Teacher modeling and YouTube videos: How To Use a Microscope, TCCMedia Crew. Making a Wet Mount for Microscopy, Oliver Kim.

What is refraction index?

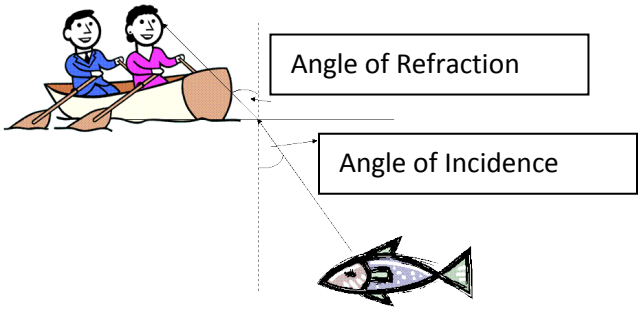
Light travels slower through different mediums such as glass, water and air. These mediums are given a refractive index to describe by how much they slow the movement of light. (e.x. The refractive index of water is 1.3 while the refractive index of air is 1.0003, meaning that air only slightly slows down light). http://www.sciencekids.co.nz/sciencefacts/light.html

2. Students will learn the basic concepts of Snell's Law.

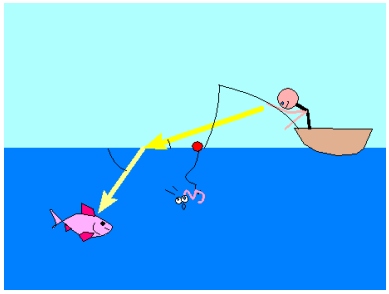
What is Snell's Law?

Snell's Law for the Refraction of Light. When visible light enters a transparent material such as glass or water at an angle, the direction of the light is refracted or bent at a different angle. Definition by Ron Kurtus (revised 8

September 2005).



arstechnica.com



faculty.weber.edu

http://orbitsimulator.com/Physics6/SnellsLawQuiz.html

Instructions:

Students will take turns mounting the hair samples. Each group of five students will have a set of eight small envelopes labeled as follows:

A (black human hair), B (blond human hair), C (gray human hair), D (dye human hair), and E (white dog hair), F (brown dog hair), G (yellow cat hair), and H (black cat hair).

Teacher will prepare each lab table with a light microscope, 4 microscope slides, 4 cover slips, tweezers, and tissue paper. Students will conduct dry and wet mounts of the hair samples. For the dry mount, students will align the hair samples parallel to each other. It is not necessary to align the hair samples when conducting a wet mount. Students will have two observations logs, one for the dry mount and another one for the wet mount.

Dry mount: Students will compare the hair samples as indicated in their observation logs. They will look for hair texture, color, thickness, and shape (straight, wavy, and curly).

Wet mount: Students will compare the hair samples as indicated in their observation logs. The refraction index might allow them to observe more details of the hair such as the cuticle (scales), cortex, and medulla, if it present in the hair sample.

After the students finish their observations logs, teacher will display the SEM pictures of the hair samples for students to compare and contrast them to the light microscopes images. Students will have an understanding of how small SEM micrometer hair images are compared to light microscope hair images.

Each group will compare and draw conclusions about their observation logs.

Evaluation:

- Students Reflection Science Journals.
- Students' worksheet # 2 # 3 finished.
- Teacher reflection about the outcomes.
- Feedback from the Culture Teacher.
- Pre-Test and Post Test - Arizona Harcourt Science Curriculum (2006) on Reflection, Refraction, Refraction Index, and Introduction to Snell's Law .

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Lesson 2

Objectives

Students will:

1. Understand what a quantum dot is.
2. Analyze how quantum dots interact differently with light.
3. How changing the size of gold and silver quantum dots affects their color.
4. Learn about the different uses of quantum dots in technology and their future uses in medicine.
5. Understand the basic concept of quantum dots confinement (trapped-particle in a box).

What is a quantum dot?

Quantum dots are semiconductor nanoparticles that glow a particular color after being illuminated by light. The color they glow depends on the size of the nanoparticle. Quantum dots are nanoparticles made of any semiconductor material such as silicon, cadmium selenide, cadmium sulfide, or indium arsenide.

What is a semiconductor:

It is a material that conducts current, but only partly. Semiconductors are made out of crystal, usually silicon crystals. Every silicon atom has four valence electrons.

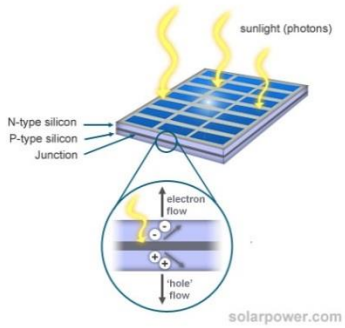
Definition: http://dummies.com/how-to/content/electronics-basics-what-is-a-semiconductor.html

Materials:

- YouTube Video: Quantum Dot's Learning Adventure. NIBIBTV. The National Institute of Biomedical Imaging and Bioengineering is one of 27 Institutes and Centers that comprise the National Institutes of Health (NIH).
- Teacher created worksheet # 4 - how gold and silver quantum dots are different sizes and colors
- Different sizes Scanning Electron Microscope (SEM) images of quantum dots at the nanoscale (Chang, Kenneth. "Tiny is beautiful: Translating "Nano" Into Practical." New York Times 22 Feb 2005: Science).
- Quarks 6 Packs
- QCD Dots 9-pack – Quantum Chromodynamic dots

Rationale:

- Application - Students will understand how quantum dots are currently used in the clothes people wear, sports gear, and solar cells.



- People make quantum dots with a special machine calledMolecular Beam Epitaxy (MEB).

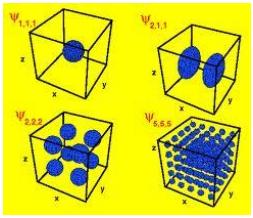

http://www.r-j-y.com/research/lancaster

- Quantum dots are crystals made of atoms arranged in repetitive, orderly, geometric 3-D patterns.

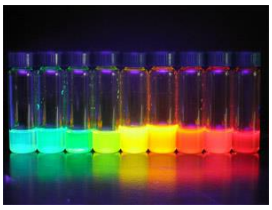

http://p2ilabs.blogspot.com/2012_11_01_archive.html

- When quantum dots are excited, they emit a colorful glow, but they may also emit other kinds of energy such as heat.

- Students will understand the basic concept of quantum dots confinement. Since quantum dots are semiconductors, and they can be squeezed or trapped down inside a little space, like a little box, causing energy changes (Particle in a box).


box3_00.gifdepts.washington.edu

- Quantum dots are semiconductors and can give off light energy depending on their size.


http://depts.washington.edu/chem/people/faculty/ginger.html

Activities:

Cultural Connections:

Teacher will teach the story *Why Coyote isn't Blue,* North American Pima Legend. Byrd Baylor, *And It Is Still That Way, Legends told by Arizona Indian Children* (1998).

Why I chose this story?
Students will:

1. Understand that not following detailed directions generally conducts to failure
2. Compare and contrast how coyote wanted to turn blue and how quantum dots can turn into different colors when light strikes them.
3. Learn about the kindness of the birds when they teach another being why they are blue.
4. Understand why being proud of oneself can result in undesired consequences.
5. Learn why vanity is sometimes punishable

Ils.unc.edu/~sturm/storytelling/cuecards/whycoyoteisnotblue(Keesee).htm

Students will observe different SEM images of gold and silver nanoparticles. They will understand and draw conclusions on how gold and silver nanoparticles change colors depending on their size (nanometers). Students will be given worksheet # 4 where they will answer how many nanometers each gold and silver particle is according to their size and color. They will record either how many nanometers each gold and silver particle is, or they will identify the color of each nanoparticle.

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Prerequisite:

What is a quark?

Quarks are believed to be the basic building blocks of protons, neutrons and a wide variety of other, heavier particles called hadrons. Just as atoms are primarily composed of different combination of protons, neutrons, and electrons, hadrons are believed to be composed of different combinations of quarks. Quarks are thought of as elementary particles, i.e. particles that cannot be further broken down into other particles by any known means. http://www.pa.msu.edu/sciencet/ask_st/021292.html

What is a Quantum Chromodynamic Dot?

It is the strong interaction (force) of color. The superconductivity of color.

Students will play with the set of quarks and attached quantum chromodynamic dots (QDC) to observe how the QDC change colors.

www.particlezoo.net

Evaluation:

- Students Reflection Science Journals.
- Students' worksheet # 4 finished.
- Teacher reflection about the outcomes.
- Feedback from the Culture Teacher.

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Lab Work 2

Objectives

Student will:

1. Understand the difference between a nano, nanoparticle, and a quantum dot.
2. Understand nano is a very small unit of measure (10^{-9}).
3. Understand that nanoparticles do not emit light.
4. Understand that quantum dots (QD) are semiconductors. They absorb and emit light. QD are man-made nanoparticles that glow a particular color after being illuminated by light.

Materials:

- Gold nanoparticles of 5 nm, 50 nm, 100 nm, and 250 nm
- Different color lasers
- SpectroVis spectrophotometer and optical fiber cable
- BrainPop Jr. "Light" Video Clip and activities

Prerequisite: 1. Students will define the following words:

Light: Type of energy known as electromagnetic radiation. This type of radiation is heat produced by the sun.
Heat: The movement of thermal energy.
Reflection: When light strikes an object, some of the light bounces off the objecting.
Absorption: Objects that don't let the light pass through them are opaque and the light is absorbed.

2. How to use a SpectroVis Plus Spectrophotomer and Optical Fiber Cable. Teacher Modeling.
Students will learn how white light can be split into colored light. Describe how objects absorb light in different amounts.

3. Watch the BrainPopJr. Video Clip and do the activities included.

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Activities:

Cultural Connections:

Gaining awareness of Worldviews. Students will compare the easiest concepts between Indigenous Worldviews and the Western/Eurocentric Worldview. This activity will teach them how global knowledge interprets science and how Indigenous people understand science.

Cosmic Serpent: Collaboration with Integrity. National Science Foundation Grant. Begay, David and Collaborators (2012).

Indigenous Worldviews	Western/Eurocentric WorldView (Global Knowledge)
Spirituality is a way of life.	Spirituality is not always a way of life.
Nature and Elders hold the knowledge (songs and stories).	Library is holder of knowledge.
Natural resources are viewed as gifts.	Natural resources are set aside for human enjoyment or available for human/use consumption.
Nature is honored continually through daily spiritual practice.	Spiritual practices are set apart from scientific practices.
Humans are responsible for maintaining harmonious relationship with the natural world.	Humans depend on Earth's land, ocean, sun, etc….different resources.
Cyclical thinking , Insightfulness	Linear thinking, right to the point
Man and nature are inseparable	Separation of Man and Nature
The use of hypotheses, experimentation and replication is of lesser value.	Scientific methods include hypothesis experimentation and replication Keen observation

Adapted by Martha Rogers

Students will read the story *How Things were Made, The Earth is Made – Mash Has Masma Ha'ichu e Nahto – Mash e Nahto g Jewed.* The story is written in O'odham Language and in English by (Jose Pancho; Mason, J. Alden, Pagago Texts. American Philosophican Society Library Archives, 59-62). Extracted from the Book *Legends and Lore of the Papago (previously known) and Pima Indians by Dean and Lucille Saxton (1969).* Pages 1 to 10.

The Culture Teacher will be invited to read the story in O'odham and teacher will read it in English. The students will discussed the story and compare it as follows:

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Light/Sun Student Friendly Explanation	Light/Sun Western Science Explanation	Light/Sun Tohono O'odham Explanation O'odham Language and English Language
The Sun is a star and a body of hot gases and it makes its own light and heat. The Sun is the center of our solar system and all the planets orbit around it. The Sun is the closest star to the Earth, but it is still 93,000,000 miles away. The Sun is a lot bigger than the Earth. The Sun is the largest body in our Solar System. Without the sun Earth will be pretty dark and cold. The Sun is made of burning hot gases. It is mostly made of hydrogen and helium gases. Balloons are filled with helium gas. The sun always rises in the east, and sets in the west. The gases in the sun go through a lot of changes that give off a lot of energy. The outer part of the sun is 10,000 degrees Fahrenheit (^{0}F)/5,000 degrees Celsius (^{0}C). The Sun's core is hotter. It is about 27,000,000^0 F and 15,000,000^0 C. Our oven at home goes up to 500^0 F. The Sun gives light and heat to the Earth. Almost anything on the Earth depends on the Sun's energy in some way. Source: BrainPopJr. Movie clip "The Sun."	The sun generates energy through nuclear fusion deep in its core. Hydrogen atoms bond together to form helium, releasing energy as a result of that reaction. That energy escapes the sun in the form of light and heat. Light energy travels through empty space, where it provides energy to all of the planets and other objects in the solar system. Without energy from the sun, there would be no life on Earth. Unlike heat, which is conducted through contact, light can radiate through a vacuum. This property enables it to travel through the vacuum of space. Light energy travels at the "speed of light." Or about 300,000,000 meters per second in a vacuum. At these great speeds, it takes about 8 $^{1/3}$ minutes for light leaving the surface of the sun to travel to Earth. Source: www.hspcience.com Arizona Science Harcourt School Publisher (2006).	**How Things were Made – Summary** In the version of creation given here, Earth Medicine Man is presented as the First Born on Earth who makes all else. First Born finished the Earth, but there was no sun or moon then, and it was always dark. The living things didn't like the darkness, so they got together and told First Born to make something so the Earth would have light. Then the people would be able to see each other and would live contentedly with each other. So First Born said, "Alright, you name what will come up in the sky to give you light." They discussed it thoroughly and finally agreed that it would be named "Sun." Source: *Legends and Lore of the Papago (previously known) and Pima Indians by Dean and Lucille Saxton (1969 pages 3 and 4).*

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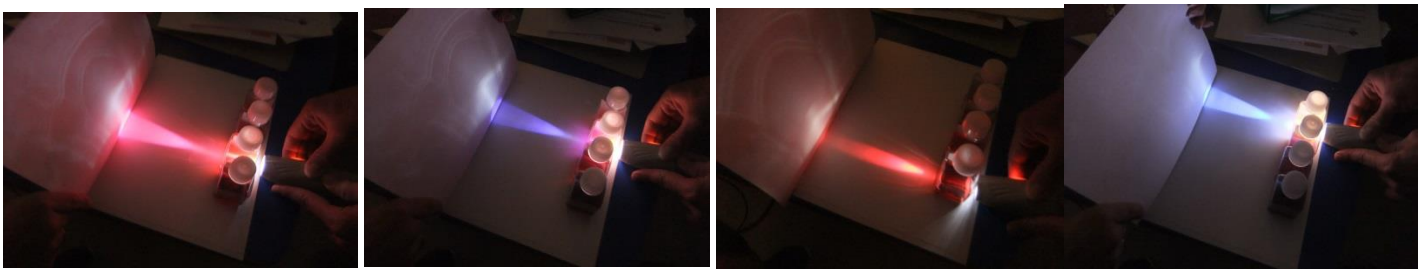
Students will observe how gold nanoparticles reflect and absorb light using different color lasers. The purpose of this study is to find out which wavelength generates more heat.

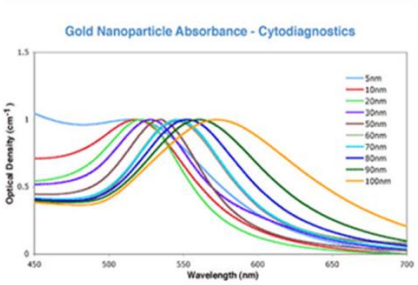


Photos taken by Martha Rogers (July 2013). White Flashlight.

Photos taken by Martha Rogers (July 2013). Green Laser light.

CONCLUSION

The green laser light was absorbed almost completely in all gold nanoparticles making the best wavelength for heating. The following graph illustrates the absorption of particles according to the different colors.



http://www.sigmaaldrich.com/materials-science/nanomaterials/gold-nanoparticles.html

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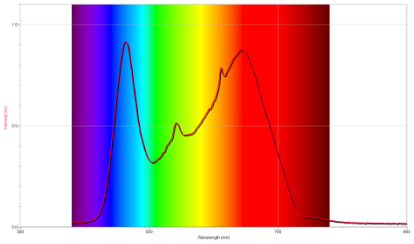
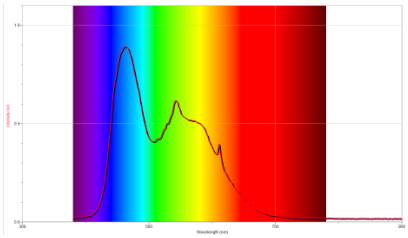
Students will use the spectrophotometer and the fiber optic cable to make predictions on how the wavelength will show off in the spectrum. They will compare a flash light spectrum and the 50nm gold particle to illustrate how the wavelength on the green part of the spectrum does not show intensity.

Gold Particle 50nm



Flash Light Spectrum



Community Connections:

Students' art, lesson, and lab work will be displayed. The teacher will invite Elders, parents, guardians, peers, Parent-Teacher Conferences to view their work. During a portion of the Parent-Teacher conferences, the students will explain to the community the work that they completed.

Evaluation:

- Students reflection science journals.
- Students' worksheet # 5 finished.
- Teacher reflection about the outcomes.
- Feedback from the Culture Teacher.
- Pre-Post Test from Arizona Science Harcourt School Publisher 2006 on Light and Color Relation. Physical Science Investigating Matter and Energy.