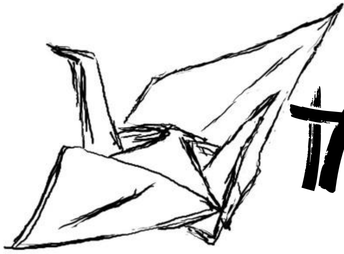
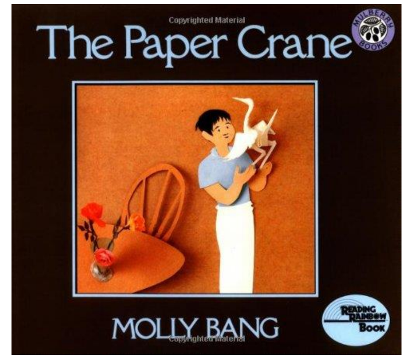


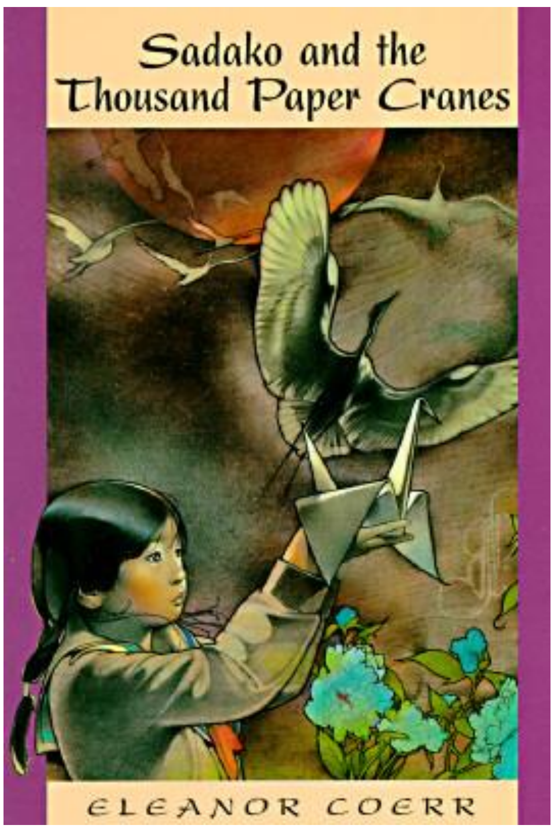
the wings of the crane



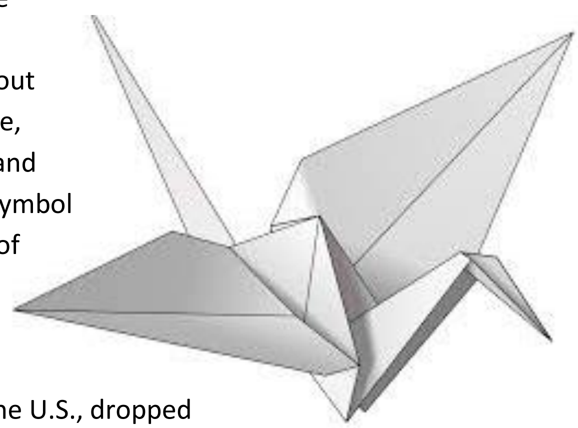
unit one: day one

To catch student's attention and introduce the idea of folding paper-as well as access prior knowledge read a picture book with students such as, *The Paper Crane* by Molly Bang, *Fold Me a Poem* by Kristine O'Connell George, *The Origami Master* by Nathaniel Lachenmeyer.

A Flock of Thousands



Perhaps the most well-known origami model is the crane. It has become the international symbol of peace. In Japan every child eventually learns to make the crane. Eleanor Coerr is credited with popularizing the crane with her book, "Sadako and 1,000 Paper Cranes." A book, which tells the story of Sadako. Sadako's story is about war, radiation, peace, and determination and she is to this day a symbol of innocent victims of war. She was exposed to the radiation from the atomic bomb that the U.S., dropped which helped to end World War Two.



But signing the truce didn't stop the death of many who were exposed to massive amounts of radiation during the atomic bombings at Hiroshima and Nagasaki. **(Using a map locate and label where Hiroshima and Nagasaki are.)**

The Atomic Bombings of Hiroshima and Nagasaki killed about 250, 000 people and became one of the most dreadful slaughter of civilians in modern history.

On August 6, 1945, 8.15 am, the uranium atom bomb exploded 580 meters above the city of Hiroshima with a blinding flash, creating a giant fireball and sending surface temperatures to 4,000C. Fierce heat rays and radiation burst out in every direction, unleashing a high pressure shockwave, vaporizing tens of thousands of people and animals, melting buildings and streetcars, reducing a 400-year-old city to dust.

The city was levelled, there were very few buildings with foundations of steel and stone. Anyone who wasn't instantly vaporized had been hit by the explosive blast and then a firestorm. The survivors could then die from the effects of radiation in the next few minutes, months or years... The dead left shadows on walls as housewives and children were incinerated instantly or paralyzed in their daily routines, their internal organs boiled and their bones charred into brittle charcoal.

The intense heat and light of the Hiroshima and Nagasaki atomic bomb blasts left behind ghostly silhouettes of human beings

Beneath the center of the explosion, temperatures were hot enough to melt concrete and steel. Within seconds, 75,000 people had been killed or fatally injured instantly with 65% of the casualties nine years of age and younger. 70,000 additional people were injured. It's the largest death toll ever caused by a single weapon. (And the number still grows, decades later, that exposure to radiation is still killing the survivors of the bombings of Hiroshima and Nagasaki in the form of cancers and other effects.)

Radiation deaths were still occurring in large numbers in the following days. "For no apparent reason their health began to fail. They lost appetite. Their hair fell out. Bluish spots appeared on their bodies. And then bleeding began from the ears, nose and mouth".

Doctors "gave their patients Vitamin A injections. The results were horrible. The flesh started rotting from the hole caused by the injection of the needle. And in every case the victim died". The doctors were trying to deal with radiation sickness, when no research or treatment yet existed.

Coroner's Report: Atomic Bomb http://www.history.com/topics/world-war-ii/trinity-test/videos/atomic-bomb (3 min) TV-14 (May not be appropriate for younger or more sensitive students.)

Watch the following video clip Hiroshima: Ground Zero 1945 http://vimeo.com/24030100 or at http://www.icp.org/museum/exhibitions/hiroshima-ground-zero-1945 *After the United States detonated an atomic bomb at Hiroshima on August 6, 1945, the U.S. government restricted the circulation of images of the bomb's deadly effect. President Truman dispatched some 1,150 military personnel and civilians, including photographers, to record the destruction as part of the United States Strategic Bombing Survey. The goal of the Survey's Physical Damage Division was to photograph and analyze methodically the impact of this new weapon, the atomic bomb, on various building materials* *surrounding the blast site, the first "Ground Zero." The haunting, once-classified images of absence and annihilation formed the basis for civil defense architecture in the United States. This exhibition includes approximately 60 contact prints drawn from a unique archive of more than 700 photographs in the collection of the International Center of Photography. The exhibition is organized Erin Barnett, Assistant Curator of Collections.*

Watch 6 short clips from the excellent BBC Documentary Hiroshima & Nagasaki, available at the following link: https://www.youtube.com/watch?v=7jS4muIxFkw&list=PL3FB5BBB3C71306BF

- **Testing the atomic bomb and destroying lives in Japan:** *The first ever atomic bomb testing left the scientists not only amazed, but also apprehensive about the nature of the beast they had created. Video from BBC Worldwide. Note: Robert Oppenheimer, the Supervising Scientist of the Manhattan Project who has been called "the father of the atomic bomb," quoted these words from the poetry of the Bhagavad-Gita, after watching the first detonation of a nuclear weapon.'*

  If the radiance of a thousand suns
  Were to burst at once into the sky
  That would be like the splendor of the Mighty One ...
  I am become Death,
  The Destroyer of Worlds.
  —Bhagavad-Gita

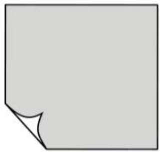
- **Truman's ultimatum regarding Hiroshima:** *Japanese soldiers and civilians alike are being trained to attack American troops. Truman offers a fateful ultimatum at the Potsdam conference - All hope of reconciliation seems lost.*
- **Hiroshima: Dropping the Bomb:** *Hear first-hand accounts from the air and ground, re-telling every memory from the day the world first witnessed the horrors of atomic warfare.*
- **US troops preparing to drop the atomic bomb on Hiroshima:** *In the final briefing, American troops are told this will just be another day, another bombing. Soon enough, however, the event causes a media storm. Hear first-hand accounts from the crew that flew the atom bomb to Japan in this clip from the BBC.*
- **Atomic bombing of Nagasaki:** *Accounts of the American justification for dropping a second bomb in Nagasaki (40,000 more immediate deaths, 40,000 additional slow deaths by the end of the year.)*
- **Remembering the tragic aftermath of the Hiroshima bomb: I***n this moving clip Hiroshima residents talk through their first memories after the bomb had fallen.*

Folding Peace

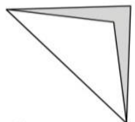
- Students will now learn how to fold their own paper cranes. Folding a paper crane is like making peace -- some of the steps are awkward. At first it may seem impossible. There is definitely more than one route. Patience and consultation are helpful. And the result, big or small, is a thing of beauty.

HOW TO FOLD A PAPER CRANE

Begin with a **square** piece of paper — ideally one side colored and the other plain. Place the colored side face up on the table. In all diagrams, the shaded part represents the colored side.

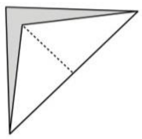


1 Fold diagonally to form a triangle. Be sure the points line up. Make all creases very sharp. You can even use your thumbnail.

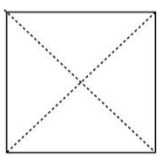


Unfold the paper. (important!)

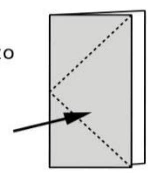
2 Now fold the paper diagonally in the *opposite* direction, forming a new triangle.



Unfold the paper and **turn it over** so the white side is up. The dotted lines in the diagram are creases you have already made.

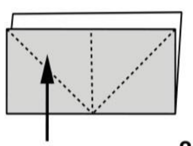


3 Fold the paper in half to the "east" to form a rectangle.

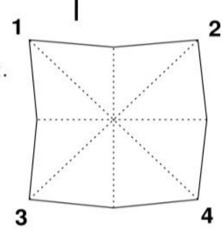


Unfold the paper.

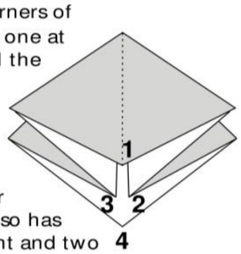
4 Fold the paper in half to the "north" to form a new rectangle.



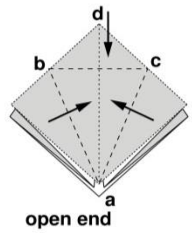
Unfold the rectangle, but don't flatten it out. Your paper will have the creases shown by the dotted lines in the figure on the right.



5 Bring all four corners of the paper together, one at a time. This will fold the paper into the flat square shown on the right. This square has an open end where all four corners of the paper come together. It also has two flaps on the right and two flaps on the left.

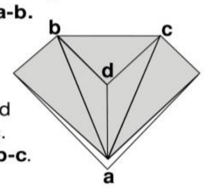


6 Lift the **upper right** flap, and fold in the direction of the arrow. Crease along line **a-c**.

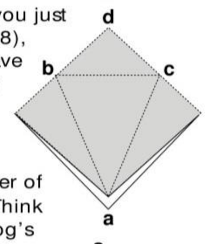


7 Lift the **upper left** flap and fold in the direction of the arrow. Crease along the line **a-b.**

8 Lift the paper at point **d** (in the upper right diagram) and fold down the triangle bdc. Crease along the line **b-c**.

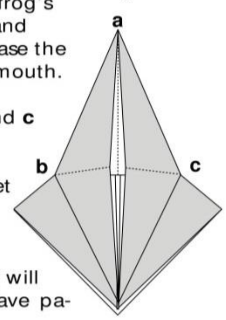


Undo the three folds you just made (steps 6, 7, and 8), and your paper will have the crease lines shown on the right.



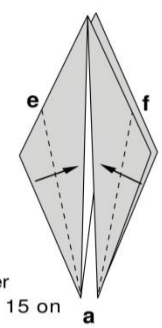
9 Lift just the top layer of the paper at point **a**. Think of this as opening a frog's mouth. Open it up and back to line b-c. Crease the line b-c **inside** frog's mouth.

Press on points **b** and **c** to **reverse** the folds along lines **a-b** and **a-c.** The trick is to get the paper to lie flat in the long diamond shape shown on the right. At first it will seem impossible. Have patience.



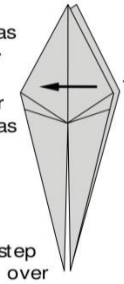
10 to 13 Turn the paper over. **Repeat** Steps 6 to 9 on this side. When you have finished, your paper will look like the diamond below with two "legs" at the bottom.

14 & 15 Taper the diamond at its legs by folding the **top** layer of each side in the direction of the arrows along lines **a-f** and **a-e** so that they meet at the center line.



16 & 17 Flip the paper over. **Repeat** steps 14 and 15 on this side to complete the tapering of the two legs.

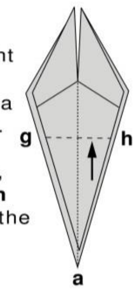
18 The figure on the right has two skinny legs. Lift the **upper** flap at point **f** (be sure it's just the upper flap), and fold it over in the direction of the arrow – as if turning the page of a book. This is called a "book fold".



Flip the entire figure over.

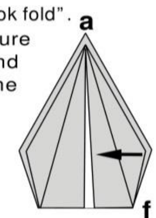
19 **Repeat** this "book fold" (step 18) on this side. Be sure to fold over only the **top** "page".

20 The figure on the right looks like a fox with two pointy ears at the top and a pointy nose at the bottom. Open the **upper** layer of the fox's mouth at point **a**, and crease it along line **g-h** so that fox's nose touches the top of the fox's ears.



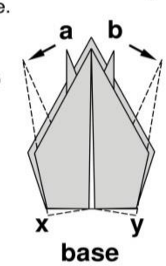
21 Turn the figure over. **Repeat** step 20 on this side so that all four points touch.

22 Now for another "book fold". Lift the **top** layer of the figure on the right (at point **f**), and fold it in the direction of the arrow.

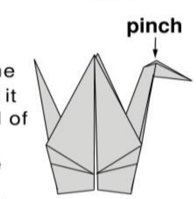


23 Flip the entire figure over. **Repeat** the "book fold" (step 22) on this side.

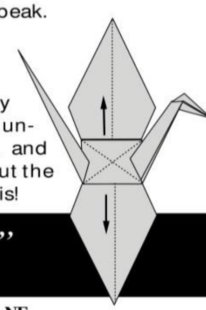
24 & 25 There are two points, **a** and **b**, below the upper flap. Pull out each one, in the direction of the arrows, as far as the dotted lines. Press down along the base (at points **x** and **y**) to make them stay in place.



26 Take the end of one of the points, and bend it down to make the head of the crane. Using your thumbnail, **reverse** the crease in the head, and **pinch** it to form the beak. The other point becomes the tail.



Open the body by blowing into the hole underneath the crane, and then gently pulling out the wings. And there it is!



"I will write 'peace' on your wings, and you will fly all over the world."

SADAKO SASAKI

Visit our website at **www.sadako.com** or write Informed Democracy, P.O. Box 67, Santa Cruz, CA 95063. Telephone: 1 800 827-0949

Day One: K-8 Standard Alignment

K

K.5.02 a. Understand the place of historical events in the context of past, present, and future.

K.5.01 a. Define history as the story of our past.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss how actions and events in the past connect to and influence our today and our tomorrows and how the actions and events we are studying still continue to influence us today.

1

1.5.01. c. Identify contributions of diverse historical figures that have influenced their community, state, nation, and/or the world.

1.5.02 Understand the place of historical events in the context of past, present, and future.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss how actions and events in the past connect to and influence our today and our tomorrows and how the actions and events by the people we are studying still continue to influence us today.

2

2.5.02 Understand the place of historical events in the context of past, present, and future.

2.6.01 Recognize the impact of individual and group decisions on citizens and communities.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss how actions and events in the past continue to have an effect, ex. what effect did dropping the bomb have on those that lived there and around the world and how does the dropping of the bomb still continue to affect those that lived in the area and people around the world?

3

3.6.01 Recognize the impact of individual and group decisions on citizens and communities.

3.5.01 Identify major people, events, and issues in United States and world history.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss how actions and events in the past continue to have an effect, ex. what effect did dropping the bomb have on those that lived there and around the world and how does the dropping of the bomb still continue to affect those that lived in the area and people around the world?

Students will be encouraged to recognize major players in the events, ex. Robert Oppenheimer, President Truman, and historical figures who have become 'major people' such as Sadako.

4

4.5.02 Understand the place of historical events in the context of past, present and future.

4.5.05 a. Compare and contrast different stories or accounts about past events, people, places, or situations, identifying how they contribute to our understanding of the past.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss how/whether or not each version or piece of the story adds to ur understanding of what happened and why it happened.

5

5.5.09 Understand America's role during World War II.

5.5.09 b. Identify the significance of […]Hiroshima.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. Students will be asked prior to the discussion whether or not they have ever heard of Hiroshima, whether it was significant, and will be asked to share what they know. After we have watched, listened, discussed, and learned they *will be asked if their understanding of the significance of Hiroshima has changed and how, why, or why not.*

6

6.4.02 c. Explain and apply concepts such as power, role, status, justice and influence to the examination of [historical] issues, events, and social problems.

RH.6-8.7. Integrate visual information (e.g., graphics, photographs, videos, or maps) with other information gained from print and digital texts to develop a coherent understanding of a topic or issue.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss what students think the major reasons were for dropping the bomb (was it for power?), what roles individuals had in that and the decisions that led up to it, whether or not students think it was a just decision (before they learn more about the reasons behind it—then we will see later if their opinion changes), and what might have been the issues/things that influenced the decision makers. After we have watched, listened, discussed, and learned they will be asked if their understanding of the significance of Hiroshima has changed and how, why, or why not.

7

RH.6-8.7. Integrate visual information (e.g., graphics, photographs, videos, or maps) with other information gained from print and digital texts to develop a coherent understanding of a topic or issue.

7.3.08 Understand how human activities impact and modify the physical environment.

7.3.07 b. Describe the impact and interaction of [natural or manmade] hazards and disasters on human settlements and systems.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss the physical effects that the bomb drop had in the environments around Hiroshima and Nagasaki and what effects that had on the residents, and around the world at that time and what effects they continue to have today.

8

RH.6-8.7. Integrate visual information (e.g., graphics, photographs, videos, or maps) with other information gained from print and digital texts to develop a coherent understanding of a topic or issue.

8.3.03 Recognize the interaction between humans and their physical environment.

These standards will be met during the activities and discussion as students learn, listen, watch, and discuss the events covered within the context of the lesson. We will discuss the physical effects that the bomb drop had in the environments around Hiroshima and Nagasaki and what effects that had on the residents, and around the world at that time and what effects they continue to have today.

unit one: day two

Continue with the story and clips from Day One: (students can work on their cranes as they listen to the story.)

Approximately ten years after the bomb dropped, a young vibrant energetic girl who loves running and was about to graduate from elementary school In November 1954, Sadako developed swellings on her neck and behind her ears. In January 1955, purple spots had formed on her legs. Sadako is diagnosed with leukemia, also referred to, by her mother, as 'an atom bomb' disease.

According to one version of her tale, while she was in the hospital her best friend Chizuko Hamamoto came to the hospital to visit, and cut a gold piece of paper into a square to fold it into a paper crane and taught Sadako of an old folk tale. "It's an old story. To really feel better you have to make them. But they say that if you fold a thousand paper cranes the gods will be happy and they'll grant you a wish."

She told Sakako that the crane is a symbol of health and that if Sadako can make 1,000 cranes she will be well. Her friend proceeded to teach her to make the crane: it wasn't easy but when Sadako mastered it, she began her quest to make 999 more. She resolved to be brave and making the cranes takes her mind off her illness.

Learning that her illness came as a result of war, Sadako spread a message of peace as she folded her cranes. Though she had plenty of free time during her days in the hospital to fold the cranes, she lacked paper. She would use medicine wrappings and whatever else she could scrounge up. This included going to other patients' rooms to ask to use the paper from their get-well presents. Chizuko would bring paper from school for Sadako to use.

Crane by crane she attracted the attention of the hospital staff and other visitors, and they provided her with x-ray foil wrappers, magazines and other papers for her project. As other patients showed interest, she stopped folding and taught them to make the cranes too.

Soon she had folded hundreds of cranes. Her health improved and she was allowed to come home. But, in time her illness returned and her strength weakened, sadly, she wasn't able to complete her project (according to the version in *Sadako in the Thousand Paper Cranes*, there are other versions which we'll study and compare to-we can see stories evolve and change as they become myth and legends based on real events).

Around mid-October her left leg became swollen and turned purple. After her family urged her to eat something, Sadako requested tea on rice and remarked "Delicious." Those were her last words.

With less than 700 cranes completed, and with her family around her, she lapsed into a coma and died on the morning of October 25, 1955 at the age of 12. When her classmates realize that she had not been able to complete her dream they all decided to learn how to fold the crane. Soon the 1,000 cranes are complete.

The children decided to write to other children all over Japan to tell them of the story of Sadako and ask them to contribute money for a monument in her, and all of the children who had died from the effects of the atomic bomb, names to spread her message of peace. When the Japanese government learns of this plan they decide to rename a park in Hiroshima "Peace Park." There they erect a huge statue with a replica of Sakako holding up a giant crane. Her classmates were given the honor of deciding what to write on the base of the statue. This is what they chose:

This is our cry

This is our prayer

Peace in the world

Every year on August 6th, Peace Day, thousands of paper cranes are placed on the statue dedicated to Sadako.

So you see, the work of just one child has made people all over the world aware of the need for a peace. The story of her struggle for survival led directly to the creation of World Peace Day and made her a national heroine in Japan.

Today her brother Masahiro Sasaki (pictured with his sister as young children), and his son, Yuji continue her mission of peace. In August 2012 Clifton Truman Daniel (grandson of Harry Truman) met Sadako's older brother, Masahiro Sasaki (a peace activist), to pay respect to the Hiroshima survivors. Her brother is guided by what President Kennedy said in a speech to the UN General

Assembly in 1961 about the potential for destruction posed by nuclear war, "Mankind must put an end to war--or war will put an end to mankind."

Masahiro was only four years old, and his sister was two, when the bomb was dropped on Hiroshima in the morning of Aug. 6, 1945, its blinding flash, the "Pika" (Japanese for blinding light) followed by the boom, or "Don" (thunderclap) is forever etched in his memory.

He described that morning with the help of Japanese journalist, Naofumi Okomoto, and told his sister's tale in the following way. **Have students compare and contrast Masahiro's version of the story with that told in the book. How are they similar? How are they different?**

Masahiro and his two-year-old sister, Sadako were at home with their mother and grandmother, just over a mile from ground zero. Their father had already left for work.
"It was a beautiful morning, blue sky, not a cloud," said Masahiro. His grandmother called them inside saying, "it's time for breakfast."

They never heard an airplane or an air raid warning. Just as they sat down on the tatami mats near the kitchen of their modest, two-story home and started to eat "the blast came in," he said. "We were pushed to the wall," and "I was underneath the table covered by the tatami mats," said Masahiro.

His mother and grandmother were also still inside and appeared to be unhurt but Sadako was missing. She'd been "blown outside the house," and was "sitting on a box in the yard." Her clothes were burned and torn. She was dazed but not injured. "No one understood how she ended up there," he said.

They didn't know what had happened. The blue sky had turned a very dark and forbidding gray and it was suddenly quite hot. His mother and grandmother decided to leave the house and take the children to a nearby river. The bridge there might provide cover from another blast. Along the way they saw the smoke from the many fires that were now burning throughout a city that had been turned into a charred landscape. But it's the human toll he remembers most, especially a woman they walked by who was "holding a dead baby in her arms," he said. "There were people with their skin peeling off and they were totally in shock."

When they reached the riverbank he saw "lots of dead bodies floating by and people jumping in to cool off and dying."

Their grandmother decided to go to back up to the house. The children never saw her again but a few days later their father found her body in the well in front of their home. "Obviously she wanted water badly," said Masahiro.

A heavy, thick rain started to fall and cover them while they waited by the river not knowing where to go or what to do. This was the "black rain" that formed as a mix of irradiated debris from the fires whipped together by the tremendous heat and air currents fueled by these raging firestorms throughout the city. They were all exposed to a massive amount of radiation from this dark, thick and dangerous radioactive water. Breathing or swallowing the water or any food it touched could result in radiation poisoning.

Sadako after being diagnosed, photo courtesy of Sadako Legacy

They had "nothing to eat and were almost naked," because their clothes had been burned by the blast, said Masahiro. No one knew what had happened or where to go. After being there for about five hours they saw a friend coming down the river in a boat. He pulled over and they had to decide if they should wait for their grandmother to return. They climbed aboard. "It was a miracle," remembered Masahiro.

They sailed for about four hours and finally found a community shelter. Their father eventually found them and the family was reunited. It would take years for things to begin to return to normal.

Like so many of their friends, Masahiro and his sister, Sadako, put the horrors of that day behind them. She grew into a vibrant young woman, an outstanding runner who excelled at gymnastics. She was a bit of a "tomboy" with a good nature. She had an active life and dreamed about her future. Of course, her older brother always annoyed her.

They both thought they were fine but in October of 1954, just short of ten years after the bomb exploded, his sister noticed she had swollen lymph nodes and was sent to the doctors at the American run Atomic Bomb Casualty Commission. They diagnosed her as having leukemia brought on by the radiation.

The disease progressed rapidly. She was confined to the hospital just one month later. Her parents never told her she had leukemia and she never told them that she knew. They all wanted to protect the feelings of each other.

She knew the prognosis wasn't good and she didn't want to die. Her father told her a Japanese legend that said if you folded one thousand paper cranes you would be granted a wish. She began furiously folding cranes. She made 1,000 and started on a second batch. Her classmates, family and friends pitched in. But unfortunately, she was only able to fold 644 more cranes and died Oct. 25, 1955 -- not quite a year after being diagnosed.

She put up a brave front until the end.

She only cried once. As her symptoms were getting worse and worse, she asked her mother to stay with her overnight. She had never asked her mother to stay in the hospital with her. But her symptoms were getting unbearable and she couldn't eat anything. Her mother held Sadako close to her chest, as one would hold a newborn baby, as she listened to story after story. The next morning her mother had to go to work. Sadako was dragging her pained body, and her legs to the front of the elevator. She knew this was the last time she would see her. She understood the limitation of her life but she told her mother she was fine and to go to work. As the elevator doors closed, Sadako began to cry. She died that day.

Her classmates continued the folding and created 356 more cranes so that she was buried surrounded by 1,000 cranes.

Masahiro hopes we can learn a lesson from Sadako's short life.

"Her death gave us a big goal. Small peace is so important with compassion and delicacy it will become big like a ripple effect. She showed us how to do it. It is my, and the Sasaki family's responsibility to tell her story to the world. I believe if you don't create a small peace, you can't create a bigger peace. I like to gather those good wishes and good will and spread to the world," said Masahiro.

As part of his "goal" to spread Sadako's message, Masahiro presented one of the last origami cranes she folded to the USS Arizona Memorial on Sept. 21, 2013.

Have students compare and contrast several different versions and visions of Sadako's story and the story of Hiroshima in poem, story, book and film form. What is different about each one? What is the same? What do we learn about Sadako and Hiroshima from each? What is the author or creator of each version trying to tell/show their audience?

- **The short film Sadako** from **Andy Mai at** http://vimeo.com/10082378
- **Sadako Sasaki Story** https://www.youtube.com/watch?v=x_gGP-4Cwhc Sadako Sasaki Hiroshima story told in the form of a Japanese fairy tale with rare English subtitles
- **Sadako Story "INORI"** https://www.youtube.com/watch?v=fPlAzO0mGT4
- Crane (inspired by Sadako's story) http://vimeo.com/24228899
- A Thousand Cranes from Ritual Theatre Company http://vimeo.com/17657145
- Read the book "Peace Crane" by Sheila Hamanaka

Cranes over Hiroshima

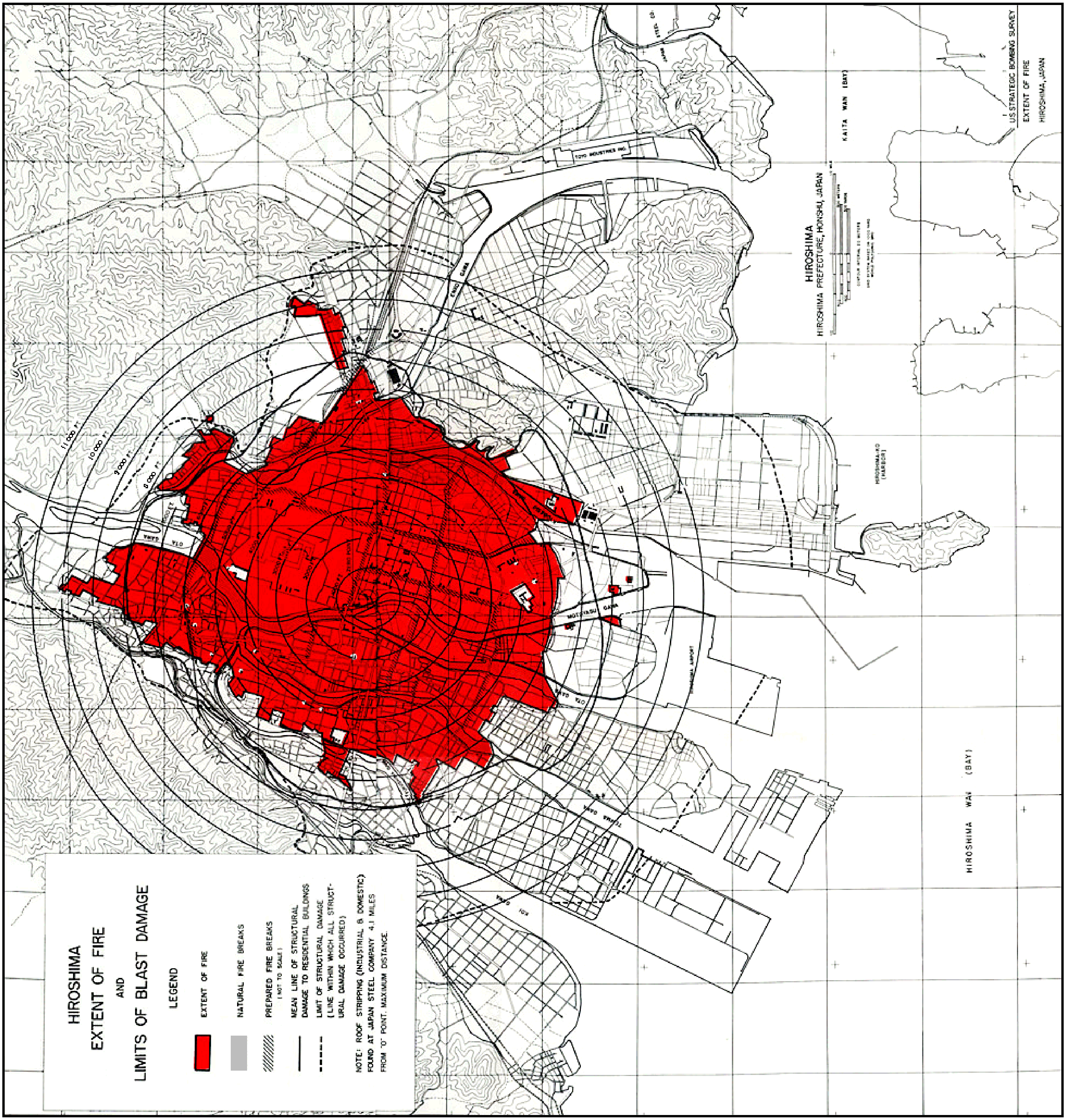
Poem/Song Lyrics by Fred Small-inspired by the story of Sadako

```
The baby blinks her eyes as the sun falls from the sky
She feels the stings of a thousand fires as the city around her dies
Some sleep beneath the rubble, some wake to a different world
From the crying babe will grow a laughing girl

Ten summers fade to autumn, ten winters' snows have passed
She's a child of dreams and dances, she's a racer strong and fast
But the headaches come ever more often and the dizziness always returns
And the word that she hears is leukemia and it burns


{Refrain}
Cranes over Hiroshima, white and red and gold
Flicker in the sunlight like a million vanished souls
I will fold these cranes of paper to a thousand one by one
And I'll fly away when I'm done

Her ancestors knew the legend - if you make a thousand cranes
From squares of colored paper, it will take the pain away
With loving hands she folds them, six hundred forty-four
Till the morning her stumbling fingers can't fold anymore
{Refrain}

Her friends did not forget her - crane after crane they made
Until they reached a thousand and laid them upon her grave
People from everywhere gathered, together a prayer they said
And they wrote the words in granite so none can forget

This is our cry, this is our prayer, peace in the world (3x)
```

Why Sadako Sasaki? Many are amazed and perplexed by her renown, by the fact that her story continues to move and inspire so many people across the world to this day. There are many others who suffered and were sick because of the bomb, what was it that made it (or her) so powerful?

When students have an understanding of Sadako's experience, ask them to consider what they would do for a friend going through a similar experience. Do they have any friends or family going through a similar experience?

Option: Explore the relationship between origami, leukemia, and the bomb. There is an intriguing science, beauty or danger to all of them, but most of all each has power. Could this power also have something to do with the impact of Sadako's story?



View this map onscreen and in greater detail at
http://upload.wikimedia.org/wikipedia/commons/6/62/Hiroshima_Damage_Map.gif

Day Two: K-8 Standard Alignment

K

K.6.02 Understand how groups can impact change at the local, state, national, and world levels.

K.5.01 b. Recall and learn about events in the past and present in order to recognize that individuals have a personal history.

These standards will be met when we discuss Sadako's life, death, and influence, for example Masahiro's statements. Students will be asked whether they think Sadako's legacy has caused change (ex. brought peace, or a desire for peace around the world) at any level.

1

1.6.01a Understand the impact of individual and group decisions on citizens and communities.

1.6.01.e. Explain the consequences of an individual's decisions and actions.

1.6.01 b. Recognize individuals have responsibilities to the group whether as a leader or as a member.

These standards will be met when we discuss Sadako's life, death, and influence, for example Masahiro's statements. We will discuss the consequences of her decision to fold cranes, the consequences of other children folding cranes, and the consequences of her family telling her story. Students will be asked whether they think Sadako's legacy has caused change at any level and whether or not she set out to be a leader, and whether or not she is one regardless of her intent.

2

2.6.02 Understand how individuals and/or groups can impact change at the local, state, national, and world levels.

2.6.01 Recognize the impact of individual and group decisions on citizens and communities.

These standards will be met when we discuss Sadako's life, death, and influence, for example Masahiro's statements. We will discuss the consequences of her decision to fold cranes, the consequences of other children folding cranes, and the consequences of her family telling her story. Students will be asked whether *they think Sadako's legacy has caused change at any level and whether or not she set out to be a leader, and whether or not she is one regardless of her intent.*

3

3.5.02 b. Describe how individuals, events, and ideas cause change over time.

3.6.02 a. Identify examples of actions individuals and groups can take to improve the [local, state, national, or worldwide] community.

These standards will be met when we discuss Sadako's life, death, and influence, for example Masahiro's statements. We will discuss the consequences of her decision to fold cranes, the consequences of other children folding cranes, and the consequences of her family telling her story. Students will be asked whether they think Sadako's legacy (and her family's actions) has caused change at any level and whether or not she set out to be a leader/heroine, and whether or not she is one regardless of her intent.

4

4.4.03 c. Explain action citizens take and have taken to influence public policy decisions.

4.5.05 a. Compare and contrast different stories or accounts about past events, people, places, or situations, identifying how they contribute to our understanding of the past.

These standards will be met when we discuss Sadako's brother's actions, the creation of World Peace Day, her statue, President Kennedy's statement etc. Have these actions influenced public feelings and/or public policy in student's opinions? We will look at the similarities and differences between the several different tellings of Sadako's story as well as the different version of the story of that day by other authors. We will discuss whether or not students think that seeing several versions gives them a better understanding of the issue(s) than only reading or seeing one single version.

5

5.5.09 b. Identify the significance of […]Hiroshima.

5.6.02 Understand how groups an individuals can create change at the local, state, national, and international level.

These standards will be met when we continue what we began the previous day and have students recall whether or not they thought Hiroshima was a significant event. Once again, after we have watched, listened, discussed, and learned they will be asked if their understanding of the significance of Hiroshima has changed and how, why, or why not. How does/doesn't additional information, especially personal perspectives, influence our own perception of 'large scale' events? Does it make a difference to 'put a face' on an issue?

6

6.6.02 Understand how individuals and groups can impact change at world levels.

6.6.01. a. Recognize that individuals can belong to groups but still have their own identity.

These standards will be met when we discuss Sadako's life, death, and influence, for example Masahiro's statements and actions and whether or not students think she, her actions, the actions in honor of her, and her legacy have impacted change at a world level.

We will discuss how Sadako was a member of 'the enemy' of the United States at the time, but she was also her own person and just a little girl (who has now become an international heroine.) How does/doesn't additional information, especially personal perspectives, influence our own perception of 'large scale' events? Does it make a difference to 'put a face' on an issue?

7

7.3.08 Understand how human activities impact and modify the physical environment.

7.3.07 b. Describe the impact and interaction of [natural or manmade] hazards and disasters on human settlements and systems.

These standards will be met when students discuss the physical effects that the bomb drop had on Sadako and her family as well as in the environments around Hiroshima and Nagasaki and what effects that had on the residents, and around the world at that time and what effects they continue to have today.

8

8.3.03 Recognize the interaction between human and physical systems.

RH.6-8.7. Integrate visual information (e.g., graphics, photographs, videos, or maps) with other information gained from print and digital texts to develop a coherent understanding of a topic or issue.

These standards will be met when students discuss the physical effects that the bomb drop had on Sadako and her family as well as in the environments around Hiroshima and Nagasaki and what effects that had on the residents, and around the world at that time and what effects they continue to have today.

We will discuss whether or not students think that seeing several versions gives them a better understanding of the issue(s) than only reading or seeing one single version.

unit one: day three

crisis brings change

Understanding the Decision to Drop the Bomb on Hiroshima and Nagasaki

At the start of World War II in 1939 the atomic bomb had not yet been invented. However, scientists discovered about that time that a powerful explosion might be possible by splitting an atom. This type of bomb could destroy large cities in a single blast and would change warfare forever.

On August 6, 1945, U.S. President Harry Truman informed the world that an atomic weapon had been detonated on the Japanese city of Hiroshima. Nicknamed Little Boy, the bomb with a power of over 20,000 tons of TNT (dynamite) destroyed most of Hiroshima, killing an estimated 130,000 people. Three days later on August 9, the Japanese had not surrendered and a second bomb nicknamed Fat Man was dropped on the Japanese city of Nagasaki destroying most of Nagasaki and killing roughly between 60,000 - 70,000 people. Six days after the bombing of Nagasaki, Japan surrendered, marking the end of World War II.

The destructive power of these nuclear weapons and number of dead have continued to prompt questions over whether the U.S. should have ever decided to use these weapons against Japan during World War II. Even 67 years after the event, the decision to drop the first atomic bomb continues to be widely debated even as the U.S. has (arguably) become the world's policeman over nuclear weapons development worldwide.

Certainly, the power of this new weapon was understood before its use against Japan. Albert Einstein came up with many of the theories that helped scientists in making the atomic bomb. When he realized that such a bomb could be made, he was frightened about what might happen if Hitler and Germany learned how to make the bomb first. He wrote a letter to US President Franklin Roosevelt telling him about the atom bomb. As a result, Roosevelt set up the Manhattan Project, in which scientists are attempting to create the first atomic bomb, in 1939. The project was so secret that FDR did not even inform his fourth-term vice president, Truman, that it even existed.

When President Roosevelt died on April 12, 1945, Truman was immediately sworn in and, soon after, was informed of the new and terrible weapon being developed by physicists in New Mexico. In his diary that night, Truman noted that he had been informed that the U.S. was perfecting an explosive great enough to destroy the whole world.

President Truman stated that “it was the most terrible thing ever discovered.” To that end, the decision to use this new weapon was not taken lightly, nor did everyone agree that it should be done, despite what historical accounts may depict. Specifically, historian J. Samuel Walker believes that history has painted a false contrast, or conflict, which says that Truman had to choose between using the atomic bomb and risking hundreds of thousands of American lives. Instead, the historical records show a much more complex situation.

As the development of the atomic bomb was nearing its completion, the U.S. was fighting a massive war with the Japanese. By all accounts, from the middle of 1944, it was clear to both the Japanese and the United States that the Japanese were losing the war and that the question was *when* not *if* the Japanese would finally capitulate/give up/surrender. As the summer of 1945 began, the U.S. military campaign continued to involve numerous aerial raids as well as large scale invasion of Japanese islands. Accordingly, before the atomic bomb became available, the U.S. was planning another large scale invasion of Japan codenamed Operation Downfall for the fall of 1945, which it hoped would overwhelm the Japanese and end the war.

Deciding to Drop the Bomb

In the lead up to the Trinity test (the first atomic device was **tested** at **Trinity** Site, New Mexico, near Alamogordo) , the top priority for President Truman was to end the war as quickly as possible with the fewest U.S. casualties. For many, this had become the overarching purpose for using the atomic bomb once it was completed. Historians note five reasons why Truman chose to use the bomb.

Reason 1: Ending the war at the earliest possible moment

The primary objective for the U.S. was to win the war at the lowest possible cost. Specifically, Truman was looking for the most effective way to end the war quickly, not for a way to not use the bomb.

Reason 2: To justify the cost of the Manhattan Project

The Manhattan Project was a secret program to which the U.S. had funneled an estimated $1,889,604,000 or one billion eight hundred eighty-nine million six hundred and four thousand (in 1945 dollars) through December 31, 1945. Since $1 in 1945 → $13.09 in 2014, how much would that be in today’s

WHAT'S IN A NAME?

Many people might think authorities gave the Manhattan Project its name to confuse foreign intelligence -- after all, the most infamous location was not in New York but hidden away in Los Alamos, N.M. So was the Manhattan Project just a random name to distract Communist spies?

It turns out there were at least 10 sites dedicated to the nuclear bomb efforts located in Manhattan, one of the five boroughs of New York City. The Army Corps of Engineers, situated at 270 Broadway, received the order to build the nuclear bomb and initially placed the project's headquarters in its own building. When authorities decided to stretch out the borders of the project in order to ensure security, the Corps still organized the construction of facilities in New Mexico, Tennessee and Washington State from its offices in Manhattan. Several other sites around New York City, including Columbia University, acted as secret research centers or uranium storehouses [source: the New York Times].

money? $1,889,604,000.00 x $13.09 = $24,734,916,360.00 (twenty-four billion seven hundred and thirty-four million nine hundred and sixteen thousand three hundred and sixty dollars.) Pretty expensive!

Karuta!

Target Maths: Any Sums
Preparation: Cards with numbers on them

This is a variation of the traditional Japanese game. It is usually best played in the gym, but sometimes you can get away with it in the class room!!

Do a review of the sums and prepare some cards, each with a number on them.

1. On one side of the room spread out lots of the cards.

2. On the other side of the room the kids form into 4 or 5 groups.

3. The kids line up in parallel lines so the first kid in each group faces the side of the room where the cards are.

4. You say a sum where the answer is on one of the cards.

5. The first kid from each group runs forward towards the cards.

6.The first kid to slap their hand down on the correct card gets a point for their team.

7. These kids return to the back of their group's line. A set of new kids are now at the front.

8. Repeat from step 4.

Make sure you have some ground rules established. For example slapping other kids hands or pushing other kids out of the way results in the offenders team losing 2 points!! Also make sure they only slap their hand onto the cards, if they try and pick them up then the cards will get all messed up.

If there is confusion as to who touched the card first to "Rock, Paper, Scissors" If there is a stage in the gym then setting the cards on the stage is a good idea. Accidents are reduced as the kids don't have to bend down to see the cards. You can also try a desktop version by putting the kids in groups and having mini cards set out on the desk.

Math War (Partner Game)

This is a partner game that can be modified for many age and skill levels. The Teacher will need a deck of number cards per pair (like uno cards minus the skips, etc, or playing cards minus the picture cards). Each player flips a card over and the first one to add the exposed numbers together wins those cards.

Note: The Teacher can modify this game and have the children subtract or multiply the numbers instead. Kids who didn't want to learn their multiplication tables suddenly want to know the answers so that they will win the game.

Matamoscas! Hae o korosu! [Kill the Flies!]

A fun and quick way to review math facts [aka. Kill the flies]. In this review game, students race to the board to swat the answers to questions posed by their teacher.

The game can be adapted for all subjects in part because all kinds of answers can be used -- numbers, shapes, and so on. The game can also be applied at all levels by adjusting the number of questions and answers, their difficulty, the degree of similarity between them.

Materials:

- Two Fly Swatters

1. Divide the group into two teams.
2. Prior to the beginning of the game have all of the answers you are going to use written up on the board [scattered randomly across your board]. The number of questions will vary according to your preferences and the grade level. You might begin with ten questions and answers, use them, and then start over with a new set of ten, and so on. Write the answers in random order on the whiteboard.
3. Choose one student from each team to come up to the front of the room and stand in front of the board with their fly swatters.
4. When you are ready to play, divide the students into two teams in lines. Read a question from your list. At your signal, the two students who are first in their lines run to the chalkboard and swat what they believe is the answer to the question. Each player must swat only one answer, and the first player to swat the correct answer earns a point for his team and erases the answer off the board.
5. If neither student chooses the correct answer, read the question again for the next students in line.
6. The students go back to their group and choose a new player to go up to the front.

7. The team with the most points at the completion of the game is the winner.

Variations

- Add to the challenge of this game by reusing some answers!
- When a student is the first to find a correct answer, you may require him or her to explain why it is the appropriate response before a point is awarded, or you could award a second point for an accurate explanation of the proper answer.

Pose difficult questions that the students can discuss as a team, with one member of each team in turn racing to "swat" the correct answer.

Day Three: K-8 Standard Alignment

K

- K.OA.2. Solve addition and subtraction word problems, and add and subtract within 10
- K.OA.5. Fluently add and subtract within 5.

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

1st

- 1.OA.6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10.
- 1.OA.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

2nd

- 2.OA.1. Use addition and subtraction within 100 to solve one- and two-step problems

- 2.OA.2. Fluently add and subtract within 20 using mental strategies.

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

3rd

- 3.OA.7.Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8)
- 3.OA.7.b) Fluently multiply and divide within 100, using strategies such as properties of operations.

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

4th

- 4.NBT.4. Fluently add and subtract multi-digit whole numbers
- 4.NBT.5.a Multiply a whole number of up to four digits by a one-digit whole number

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

5th

- 5.NBT.5. b Fluently multiply multi-digit whole numbers
- 5.NBT.5. a Perform operations (addition, subtraction, multiplication, division) with multi-digit whole numbers

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

6th

- 6.NS.2. Fluently divide multi-digit numbers
- 6.NS.3. Fluently add, subtract, multiply, and divide multi-digit numbers using the standard algorithm for each operation

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

7th

- 7.NS1.1 Apply and extend previous understandings of operations, ex. with fractions, to add, subtract, multiply, and divide rational numbers.
- 7.NS.3. Solve real-world and mathematical problems involving the four operations with rational numbers.

Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

8th

- A-APR.1. Add, subtract, and multiply polynomials.
- A-APR.7. b Solve real-world and mathematical problems involving the four operations with rational numbers and/or rational expressions.

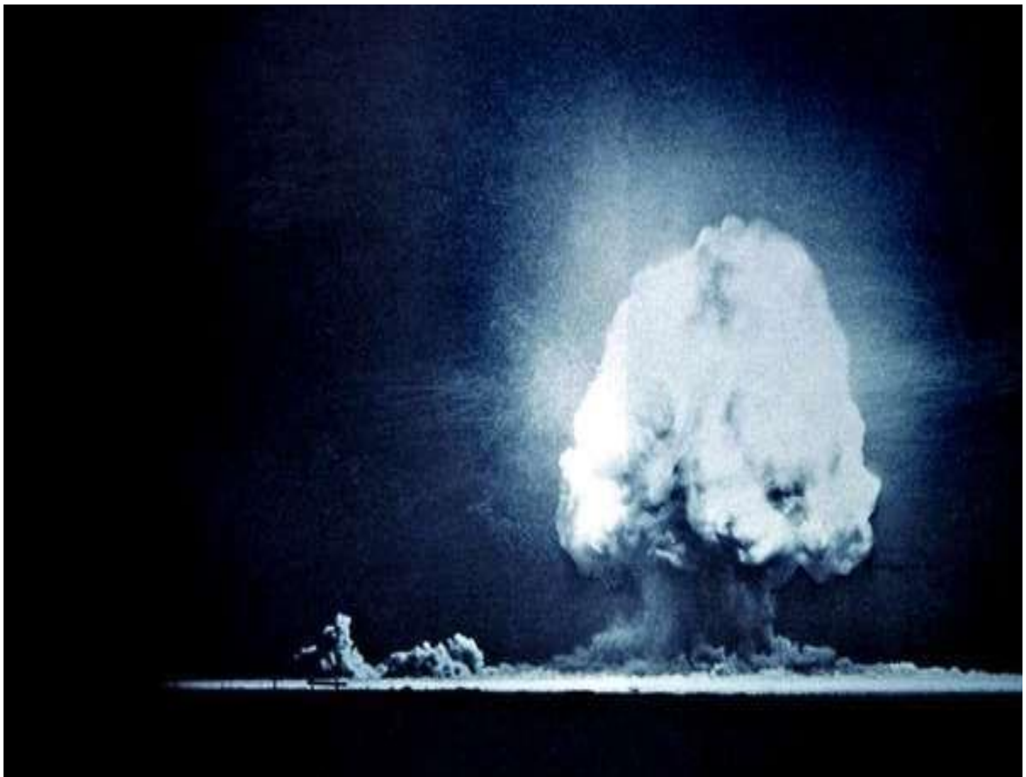
Students will practice these math skills, among others, through the selected math problem review game as we practice core math problem solving and mental math skills.

unit one: day four

The Manhattan Project?

At the start of World War II in 1939 the atomic bomb had not yet been invented. However, scientists discovered about that time that a powerful explosion of energy might be possible by splitting an atom. This type of bomb could destroy large cities in a single blast and would change warfare forever.

The development and use of the atomic bomb, the most powerful weapon created by the human race, is viewed as one of the most important and controversial events in the 20th century. Its terrifying ability to devastate an entire city and its symbol as a source of power sparked intense debate and intense competition between countries to have them.



The first explosion of an atomic bomb, pictured above, took place in New Mexico in 1945. (credit: National Park Service)

Modern warfare had changed dramatically at the beginning of the century -- airplanes, machine guns and biological and chemical warfare were just a few of the technological advancements that caused widespread devastation and altered military tactics, from primarily hand to hand combat to more distant methods of killing. But the atomic bomb was a different story. Some people thought its existence would put an end to all war **(did it? why or why not?),** while others feared the potential annihilation (complete destruction) of the human race.

A large network of scientists and military personnel had managed to create the most powerful display of energy the Earth has ever witnessed. It started small, but as the bomb became more real, the United States added scientists and funding to be sure they were the first to have the bomb. Ironically, many of the scientists involved in making the bomb had run away from Germany. By the end of the project, there were around 200,000 people working on the project around the country! And they were doing it in secret.

On July 16, 1945 the first atomic bomb was exploded in the New Mexico desert. The explosion was massive and the equivalent to 18,000 tonnes of TNT or dynamite. In his diary President Truman wrote, “Thirteen pounds of the explosive caused the complete disintegration of a steel tower 60 feet high, created a crater 6 feet deep and 1,200 feet in diameter, knocked over a steel tower 1/2 mile away and knocked men down 10,000 yards away. The explosion was visible for more than 200 miles and audible for 40 miles and more… It is certainly a good thing for the world that Hitler's crowd or Stalin's did not discover this atomic bomb. It seems to be the most terrible thing ever discovered, but it can be made the most useful.” Scientists figured that the temperature at the center of the explosion was three times hotter than at the center of the sun.

Although the scientists were happy they had successfully made the bomb, they also were sad and fearful. This bomb would change the world and could cause mass destruction and death. When President Harry Truman heard of the bomb's success he wrote "We have discovered the most terrible bomb in the history of the world".

Atomic Structure and Radioactivity

To get to the Manhattan Project and the bombings of Hiroshima and Nagasaki, it helps to understand the advancements made in physics leading up to World War II. Between 1919 and the early 1930s, scientists were piecing together the important parts of the atom's structure.

What’s an Atom?

All matter is made up of atoms . . . different kinds of atoms joined in different combinations. Everything, every single thing deserving of the designation ‘thing,’ is made of atoms. The page you are reading is made up of zillions of atoms. So are you. And so is everything else around you. Everything we touch or touch with, is made of atoms. It’s an amazing atomic Tinkertoy set that constructs us all. An atom is an exceedingly tiny thing: 200 million atoms lying side by side would span a distance of only one inch, but yet they’re made up of mostly empty space.

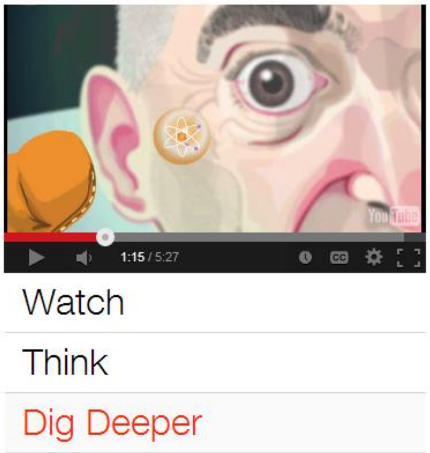
Scaling an Atom

Let's Begin…

More than 2,400 years ago, the Greek philosopher Democritus began thinking about how many times matter could be divided. He proposed that there were, in fact, tiny, indivisible pieces of matter that he called “atomos,” meaning “not to be cut.” This idea didn’t get talked about much for about 2,000 years until scientists in the 19th and 20thcenturies gathered empirical (observed and documented) evidence to support and refine it.

Just how small are atoms? And what's inside them? The answers turn out to be astounding, even for those who think they know. The following fun fascinating and fast-paced animation uses spectacular metaphors (imagine a blueberry the size of a football stadium!) to give a visceral (deep and instinctual) sense of the building blocks that make our world.

http://ed.ted.com/lessons/just-how-small-is-an-atom



And just for some amazing fascinating fun, A Boy And His Atom - The World's Smallest Movie http://vimeo.com/65244953 *At IBM research they move atoms to explore the limits of data storage. To explore the limits of filmmaking, they decided to use atoms to make the world's smallest movie! It was made by moving actual atoms, frame by frame! The ripples are the clouds of electrons on the copper surface influenced by the energy of the carbon dioxide molecules. Then, watch how they did it with this short and fascinating behind the scenes documentary to meet the scientists and see how they did it!* Moving Atoms: Making The World's Smallest Movie
http://www.youtube.com/watch?v=xA4QWwaweWA

Measuring the Miniscule

Ask students how can they guess or estimate the size of something they can't see. To help students answer this question, hold up a cardboard box that contains a "mystery object". Ask the students how they can determine what is inside of the box without opening the box and looking inside. Students should offer up suggestions such as shaking the box, weighing the box, maybe sticking a pencil inside of the box to poke around. Encourage any idea that allows the student to determine some sort of characteristic about the object inside the box.

Often we can look at or touch an object to learn about it. Sometimes, objects are too small or too large for us to learn about them this way. When this happens, we need to use indirect measurement techniques, such as those used above. Scientists use these kinds of techniques too.

One of the best characters in the history of atoms is Ernest Rutherford, a physicist in the early 20th century. In 1911, Ernest Rutherford and his colleagues Hans Geiger and Ernest Marsden accurately measured the size of the nucleus of a single gold atom. How do you think they were able to do this?

According to the tale, as told by Neil deGrasse Tyson, host of NOVA, Rutherford was the first person ever to discover how empty atoms actually are. He had this clever experiment where he had this wall of atoms, a thin film of gold, and fired particles through that thin film of gold. *To be more accurate Rutherford actually included a wide variety of different foils (such as: aluminum, iron, and lead), but his use of gold foil is most commonly spoke of.* Particles small enough to sort of maneuver their way through atoms.

Rutherford had a little sensor on this side that would sense where the alpha particles would go. And, he noticed something a little strange. Approximately 1 in 20,000 of those positively charged alpha particles shot right back at the experimenter.

And when it came shooting right back it kind of freaked out Rutherford. And Rutherford said it was like shooting a giant shell or a bullet at a piece of tissue paper and occasionally one of those bullets comes flying back at you. And he knew that it had a positive charge because those positive alpha particles were being shot back (positive repels positive, just like with magnets). So he discovered the nucleus.

During the course of his experiment though, Rutherford noticed something else that was odd. Virtually every particle he shot at his sheet of gold were detected by his instruments, suggesting that they were able to travel through the gold **without anything getting in their way**, like, at all. To make things *more* confusing, virtually none, only about 1 in 20,000, of the particles he fired were even being so much as deflected, suggesting that they were moving straight through the gold like there was nothing inside of it. Most of his particles penetrated this thin film of gold, like gold foil, and came out the other side untouched, unhindered, un-redirected, didn't collide with anything, even though it appeared solid to his eyes. And he realized, based on how many particles he shot through this field of atoms and how many came out the other side untouched, he concluded that atoms are mostly empty space. Approximately 99% of the entire physical world he was standing in was composed of nothing but empty space!

He alone knew this about atoms and the structure of matter, and he was so freaked by this that the next morning when he woke up and was ready to step out of his bed he couldn’t do it. Rutherford stopped his foot from hitting the floor and climbed back into bed, purely because he was scared his foot would slip through his floorboards and he would fall through the empty space of the atoms that comprised the wood of the wooden planks beneath his feet. As for why he didn’t think he’d slip through the atoms making up his bed, we’re guessing the part of our brain that makes us think hiding under the covers wills stop monsters was working quite hard in Rutherford’s brain that day. Eventually, sense prevailed and Rutherford did climb out of bed, eat breakfast, and change the face of physics as we know it instead of hiding and crying until he died of starvation like others might have. It was a brave first step and it's a fascinating state of mind when you've made a major discovery about the structure of matter, and no one else yet knows it.

Guessing the Size of Something You Can't See?!

Materials Needed:

• Small cardboard boxes

• An assortment of Mystery objects (same one per box and one for display)

• Electronic balance or scale

• Wood (approximately 6 inches across) cut into a triangular, circular or rectangular shape. Or, use Styrofoam insulation (1" thick) cut in shapes. More complicated shapes can be used in a second trial. Make the largest dimension of the shapes approximately 8 in.

• Large piece of plywood (which is much larger than the block and can be placed over the block). Or, use a plastic cafeteria tray or similar object to completely cover the shape.

• Marble or steel ball bearing

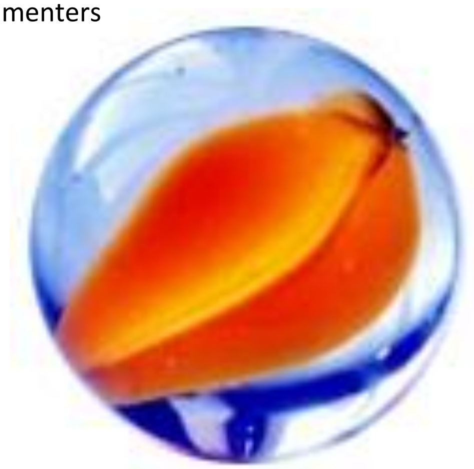
• Colored pencils (optional)

Divide the students into small groups.

Review with students how to relate each marble's angle of reflection to its angle of incidence. Meter or yard sticks can be used to retrieve "lost" marbles without posing the associated hazard of revealing the mystery shape.

Student Instructions:

As you have done experiments, you have learned to make useful observations and to draw reasonable conclusions from data. But imagine how little you would be able to accomplish if the room in which you worked were so dark that you could not see the materials you were working with. Imagine how limited your observations would be if the object of your scrutiny were so small that it could not be seen, even with a microscope. When you think of how difficult experimentation would be under such adverse conditions, you will gain some appreciation for the enormous technical problems confronting early atomic scientists. These scientists had as their target the atom—a bit of matter so small that there was no hope of seeing it directly. Nevertheless, these ingenious experimenters were able to infer that the atom had a nucleus. It is impractical to reproduce the classic experiments that led to the discovery of the nucleus in a regular classroom. You can get some idea of the challenge that these researchers faced, however, by doing the following experiment. You will infer the size and shape of an object you cannot see or touch.



Your team will receive a large wooden board, under which your teacher will place a flat shape. Your team's job is to identify the shape without ever seeing it. You can only roll marbles against the hidden object and observe the deflected paths that the marbles take.

Place a sheet of construction paper on top of the board and trace the entry and exit path for each roll of the marble as they are rolled under the board and bounce off of the object.

Use arrows to indicate the direction of motion. Your team will have five minutes to "observe" a shape. You can use different colored pencils to help you keep track of the various paths the marbles take. Analyze this information to determine the object's actual shape.

Continue rolling the marble and recording its path until you think you know the size and shape of the object. Draw a full-sized sketch of the object on a sheet of paper and answer the questions on your sheet. Check your results with your teacher. Do not look under the board until your teacher confirms your results.

Analyses and conclusions to discuss with students

1. How does this game simulate early efforts to determine the structure of the atom? In what ways is it different?
2. You eventually had the satisfaction of seeing the shape under the board. Did the early atomic scientists have this same opportunity? Do scientists today have this opportunity?
3. On the basis of the results in this lab, develop a hypothesis about how the size, shape, or identity of other kinds of objects could be determined by indirect means.

Team Members:

Trial One

Evaluate:

1. Your prediction of the shape based upon above data and observations:

2. Based on your experience, how would your team be able to improve their ability to determine the shape of the unknown object?

3. Can you tell the size of the object as well as its shape?

4. What information gave your team the best indication of the shape of the object?

5. Without looking, how can you be sure of your conclusions?

Many of the observations we make in science are indirect measurement such as you have just made! The approach we have been using is very similar in many ways to that used by scientists in studying the size, shape, and nature of elementary particles, atoms and molecules.

6. As a group, think about the above statement and decide on a definition for the term “indirect observation”. Write it here:

7. Actual Shape (following class discussion!): _____________

Mystery Box Handout

Box Number: _______

Challenge:

Hidden inside the box is an object. Your job is to find out as much as you can about the mystery object.

What do you think the object is?

How do you know?

Working with your partner or group:

1. Brainstorm the questions you might ask to find out more about the object. Write them here.

2. What kinds of tests can you design to help you answer these questions? Write them here.

3. Create a way to organize your data. Include the test, reason for the test, and observations.

4. From your data, what do you think the object in the box is? Use evidence to tell how you know.

Day Four: K-8 Standard Alignment

K

W.K.7. Participate in short term or extended shared research and writing projects based on focused questions, demonstrating understanding of the subject under investigation.

7.Inq.4 Collect, discuss, and communicate findings from a variety of investigations.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

1

W.1.7. Participate in short shared research and writing projects based on focused questions, demonstrating understanding of the subject under investigation.

7.Inq.4 Collect, discuss, and communicate findings from a variety of investigations.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

2

W.2.7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

7.Inq.4 Collect, discuss, and communicate findings from a variety of investigations.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

3

W.3.7. Conduct short research projects that build knowledge about a topic or project.

7.Inq.4 Analyze and communicate findings from multiple investigations of similar phenomena to reach a conclusion.

7.Inq.4 Identify and interpret simple patterns of evidence to communicate the findings of multiple investigations.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

4

W.4.7. Conduct short research projects that build knowledge through investigation of different aspects of a topic or project.

7.Inq.4 Identify and interpret simple patterns of evidence to communicate the findings of multiple investigations.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

5

W.5.7. Conduct short research projects to build knowledge through investigation of different aspects of a topic or project.

7.Inq.4 Identify and interpret simple patterns of evidence to communicate the findings of multiple investigations.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

6

W.6.7. Conduct short research projects based on focused questions, demonstrating understanding of the subject under investigation.

7.Inq.5 Design a method to explain the results of an investigation using descriptions, explanations, or models.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

Students will explain their results using their worksheets and determine if their data (the results of the bouncing marble) supported their conclusion (the shape that they predicted was under the board.)

7

W.7.7. Conduct short research projects to answer a question, generating additional related, focused questions for further research and investigation.

0.Inq.4 Determine if data supports or contradicts a hypothesis or conclusion.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc. They can then come up with new trials and tests to try for each other and see if they can come up with the correct answers as to what's under the board.

Students will explain their results using their worksheets and determine if their data (the results of the bouncing marble) supported their conclusion (the shape that they predicted was under the board.)

8

W.8.7. Conduct short research projects to answer a question (including a self-generated question), and generating additional related, focused questions that allow for multiple avenues of exploration.

6.Inq.5 Determine if data supports or contradicts a hypothesis or conclusion.

These standards will met as we study atoms, their discovery, their size, and complete the indirect measurement activity to better understand scientific techniques and how scientists can find/measure and learn about something they can't see. We will compare and contrast our results from several trials of the measurement activity and see if students got the same results or different ones, etc.

Students will explain their results using their worksheets and determine if their data (the results of the bouncing marble) supported their conclusion (the shape that they predicted was under the board.) They can then come up with new trials and tests to try for each other and see if they can come up with the correct answers as to what's under the board.

Wings of the Crane Unit One K-8 Academic Vocabulary Guide

K

- United States of America
- Human
- Leader
- Globe
- President
- Difference
- Story
- Respect
- Parts
- Size

1

- Past
- Present
- Future
- Rights
- Responsibilities
- Values
- Patriotic
- History
- Investigate
- Symbol
- Culture
- Citizen
- Shelter

2

- Events
- History
- Conflict
- Decision
- Symbol
- Government
- Distance
- Duty
- Authority
- Custom

3

- Tools
- Weapons
- Global
- Force
- Division
- Fact
- Effect
- Summarize
- Factor
- Threatened
- Conclusion
- Area
- Population

4

- Population
- Document
- Missions
- Political
- Energy
- Accuracy
- Author's purpose
- Audience
- Drawing conclusions
- Range
- Relationship

5

- Radiation
- Dissipate
- Region
- Bias
- View
- Solution
- Plane
- Justify
- Solution
- Visual Image
- Implied
- Point of View

6

- Energy
- Control
- Cause and effect

- Bias
- Technological
- Point of view
- Relevant
- Stressed
- Power
- Similarity
- Atmosphere

7

- Diffusion
- Physical process
- Impact
- Respiration
- Function
- Mood
- Stress
- Interaction with texts

8

- Human impact
- International
- Social norms
- Absolute
- Variation
- Neutron
- Proton
- Electron
- Exothermic
- Atom
- Family
- Tension

Wings of the Crane Unit One Sample Supply List

Day One

- Selected Books
- Access to Selected Videos (make sure to view all videos prior to class/while planning to check for their appropriateness for your students)
- Paper for folding cranes (practice making them before class/while planning to be able to help your students)
- Crane folding instructions

Day Two

- Access to Selected Videos (make sure to view all videos prior to class/while planning to check for their appropriateness for your students)
- Paper for folding cranes (practice making them before class/while planning to be able to help your students)
- Crane folding instructions

Day Three

- Number cards/playing cards
- Fly Swatters

Day Four

- Access to Selected Videos (make sure to view all videos prior to class/while planning to check for their appropriateness for your students)
- Small cardboard boxes
- An assortment of Mystery objects (same one per box and one for display)
- Electronic balance or scale
- Wood (approximately 6 inches across) cut into a triangular, circular or rectangular shape. Or, use Styrofoam insulation (1” thick) cut in shapes. More complicated shapes can be used in a second trial. Make the largest dimension of the shapes approximately 8 in.
- Large piece of plywood (which is much larger than the block and can be placed over the block). Or, use a plastic cafeteria tray or similar object to completely cover the shape.
- Marble or steel ball bearing
- Colored pencils (optional)
- Printouts