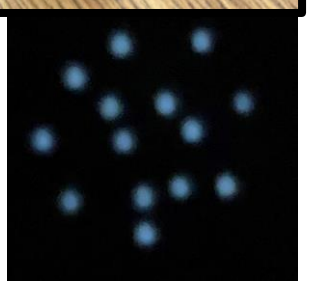
Adapted to STEMAZing ECE Format by
Amanda McPherson and DaNel Hogan

DaNel.Hogan@schools.pima.gov
Director of The STEMAZing Project

Star Light, Star Bright



NOTE: Children should always be given ample time to experiment, notice, and wonder before they are provided an explanation.

Always engage children with our two favorite questions:

What do you notice?
What do you wonder?

Resist the urge to answer any questions children have while exploring. Instead, respond back with questions to children and let them make sense of the world. Sample questions you might use: What do you think? Do you notice any patterns? What could we change? Can we test something else? What can we try next? If children ask a testable question, which they could answer by doing an experiment, talk through with them how they might design a test to help answer their question. As much as possible and within reason, let them test their questions by trying the experiments they propose.

Learning Objectives

Children will…

- describe patterns in the stars.
- learn what a constellation is, some names of constellations, and their mythology.

Key Questions

Do stars have patterns?

When are the stars visible?

Vocabulary (See **What the heck? Explanation of Science** at the end for definitions.)

Constellation
Star
Mythology
Pattern
Light Pollution

Materials

Constellation Luminary
Battery-powered tea light candle
Electrical tape
Pushpin
Paper towel tube
Star Deck (optional)
Single hole punch
Flashlight with a single LED bulb

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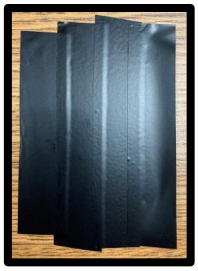
Advanced Teacher Preparation

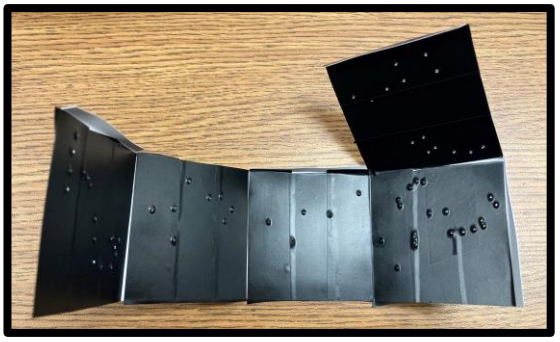
1. Cut three pieces of electrical tape about 3 inches long and arrange them in a star pattern as shown to the right. Hole punch them through the middle.

2. Pick the electrical tape star up off the table and align the hole over the top of the LED bulb as shown to the right.

3. Cut four pieces of electrical tape about 3 inches (8 cm) long and overlap them about 1/8” (3 mm) as shown below on the left.
4. Pick the electrical tape up carefully while keeping it all together in one big piece.
5. Set the tape rectangle on top of the paper towel tube and fold it over the edges. Use the pushpin to poke holes (these will be our stars) in the electrical tape, as shown in the middle picture to the right.



6. Turn the flashlight on and slide the paper towel tube over the top of the flashlight, as shown to the far right. If you want to get sneaky, you can put the flashlight (turned on) with the tube over it on a shelf or table without the children noticing just before starting the activity.



7. You will also need to construction the Constellation Luminary. It is best if printed on poly paper though cardstock will also work just fine.
8. If you want your box to work even better, after you cut it out, cover the inside faces with electrical tape, as shown to the right.
9. Then, poke holes in the box for each of the stars using a pushpin. Make holes bigger and smaller as indicated by the size of the dot for each star.
10. Tape the box together so it looks like the image on the first page.
11. If possible, make two or more of these. You will need a battery-power tea light for each.

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Notice and Wonder Developmentally Appropriate Practice

Stargazing

1. Ask children when they have seen stars. Let them describe when they have been able to see the stars, what the conditions were like, and anything else they noticed.
2. Next, have the children lie down and stare at the ceiling. Explain to them that they are getting ready to do some stargazing.
3. With the lights still on, ask them if they can see any stars.
4. Turn the lights out and let them see the stars created by the flashlight shining through the holes in the end of the paper towel tube.
    - Ask them: What do you notice? What do you wonder?
5. Tell children to focus on the stars.
    - Ask them: What patterns do you see? Can you see a person in the stars? Can you see an animal?
6. Now, tell the children that the sun is coming back up and turn the lights back on to make it “daytime”.
    - Ask them: Can you still see the stars? Do you still think they are there? How can we find out?
7. After children suggest to make the sun go down and turn the lights off to make it “nighttime” again, do it and let them see that the stars are still there.
    - Ask them: What else could keep you from seeing the stars at night?
        - They should know about clouds.
8. With the room lights still off and the stars still shining on the ceiling, turn on another flashlight and shine it in a corner or along a wall where the reflection of the light make it hard to see the stars. Don’t obscure them all together but make it so they are harder to see.
    - Ask them: Has anyone ever heard of light pollution?
        - Explain how the light from cities and towns make it harder to see the stars.
    - Ask them: Has anyone ever been camping or out away from a city and seen the night sky? What did it look like? How was it different from seeing the stars in the city?
9. Cycle through day and night a few times by turning the room lights on saying “day” and then off again saying “night”.
    - Ask them: Do you notice a simple pattern about when we can see the stars?
        - They should get to “I cannot see the stars during the daytime. I can see the stars during the nighttime.”
10. Explain to the children that scientists use patterns to make predictions, even simple patterns. Remind them that a pattern repeats.
    - Ask them: Do you think you will be able to see the stars tonight when the sun goes down?
    - Do you think you will be able to see the stars tomorrow during the day?

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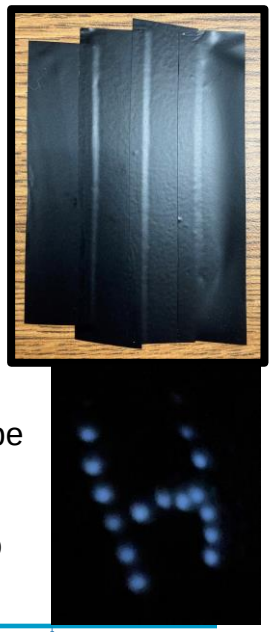
- How about the next night?
- How about the next day?
- How about next week at night?
- How about next week during the day?

11. Explain this is a good pattern because we keep supporting it with evidence. It seems as though the pattern will keep happening the same way for a very long time – billions of years!

Constellations

12. Turn on a battery-powered tea light candle and place the Constellation Luminary box over the top of it. Again, better if you can have two or more of these set up.
    - Ask them: What do you notice? What do you wonder?
13. After children have had some time to make observations, you can explain to them what constellations are – patterns in the stars that people in ancient Greece from a long time ago recognized as characters from their Greek mythology – the stories they used to share lessons and values they had.
14. For each face of the Constellation Luminary, ask the children what animal or person they think it might represent. Then share what it really is by showing them of the image drawn around the constellation (found with the stories below) and share the mythology for that constellation. You may decide to simplify some of the stories.
    - Ask them: What lesson do you think we can learn from that story?
    - Point out that people often identify Sagittarius because it looks like a teapot. Do they see it?
15. Challenge children to go out at night and look for some of the constellations on the luminary. Orion is probably the easiest one to pick out when it is up in the wintertime.

Make Your Own Constellations



16. Make additional electrical tape rectangles with four pieces of tape overlapped by about 1/8” (3 mm) as shown.
17. Put the electrical tape rectangles over the ends of paper towel tubes and let children use a pushpin to make their own constellation.
18. You could have them start with letters and numbers, like the letter H shown at the bottom right.
19. Children can try to guess what others have made by viewing them in a dark room one at a time with the flashlight shining through the tube, as before.
20. Then they can progress to making constellations on new electrical tape rectangles that represent animals or people using their imaginations, like the Greeks did.
21. Like the Greek mythological stories, they can tell or write stories to go along with their constellations.

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Children should notice…

- during the day when the sun is out, you cannot see the stars because the sun is too bright!
- you can see the stars at night if there are no clouds and the light pollution is not too bad.
- some stars make a pattern that reminded people of characters in their stories. We call these patterns in the night sky constellations.

Extensions for Additional Learning

As always, ask the children throughout the experiment what they notice and what they wonder. If their wonder questions are testable, as much as possible and within reason, let them test their questions by trying new experiments.

See below for examples of what they might wonder and experiments they might do to test their wonderings.

- I wonder why we can't see stars during the day?
- I wonder how we know the stars are still out during the day?
- I wonder if astronauts see the stars when they go to outer space or to the international space station?
- I wonder if I could find a new pattern of stars, my own constellation, in the night sky?
    - Let them try it and research it! Many of these questions can be looked up on the internet. Others can be explored by letting children try – like naming their own constellation.

#STEMAZingPictureBook Recommendation:

Find the Big Dipper by Anne Rockwell

Connections to the activity:

Pringle Can Constellation Viewer

Marshmallow Constellations

Differentiating Developmentally Appropriate Practice

For younger children, you can take them outside during the daytime to observe that you can't see the stars and then ask their parents to take them out during the nighttime to see the stars.

References

This lesson was adapted and inspired by the space unit STEMAZing Teacher Leaders Martha Bishop and Julie Bradshaw put together for their Kinder teacher peers at MUSD.

SAFETY CONCERNS

Pushpins are obviously sharp and could poke children.

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AZ Early Learning Standards

Science Standard - Strand 1: Inquiry & Application - Concept 1: Exploration, Observation & Hypotheses
The child observes, explore, and interacts with materials, others, and the environment.

Science Standard - Strand 1: Inquiry & Application - Concept 2: Investigation
The child researches their own predictions and the ideas of others through active exploration and experimentation.

Star Light, Star Bright

What the heck? Explanation of the Science (Vocabulary in bold.)

A **star** is a luminous (bright) ball of gas, mostly hydrogen and helium, held together by its own gravity into a spherical shape. The Sun is the closest star to Earth.

Earth rotates on its axis once every 24 hours (23.9 hours to be more precise), which gives us day and night. During the daytime, you cannot see the stars because the atmosphere of Earth is scattering the bright light from the Sun. This makes the dim light coming from the stars impossible to see during the daytime. At nighttime, when the Sun is behind Earth, you can see the stars. Of course, clouds can also get in the way and block out the light from the stars. Another issue that can make the stars harder to see at night is **light pollution** from cities and towns. Because the glow from all the lights people are using at night in a city great a glow, it makes it hard to see the dimmest stars though normally the brightest stars are still visible. To see the most stars and even them Milky Way galaxy, it is best to go out away from all cities and towns to observe the night sky. There are organizations like the International Dark Sky Association who help implement policies to limit light pollution from cities and towns so we will always be able to see the stars. Some of these policies include using light shielding to keep light from going up into the sky at night where it is not needed.

A **constellation** is a group of stars that appears to form a **pattern**, which people from the ancient Middle Eastern, Greek, and Roman cultures came to recognize as looking like a character from their mythology. **Mythology** is the collection of myths or stories dealing with the gods and legendary people of a particular culture. Constellations can represent people or animals from mythological stories. There are 88 official constellations. An interesting note: The Big Dipper is not a constellation! It is called an asterism, which is a recognized group of stars that may or may not be a part of a constellation. The Big Dipper is part of Ursa Major, the Greater Bear. Some asterisms cross constellations.

Due to Earth orbiting around the Sun once each year, the constellations gradually shift to the west. Different constellations can be seen during different times of the year. There are 13 astronomical zodiac constellations which are seen at different times throughout the year. These were used by ancient cultures to determine the time of year.

Reference: https://www.lpi.usra.edu/education/skytellers/constellations/

Cassiopeia – Queen of the Night Sky

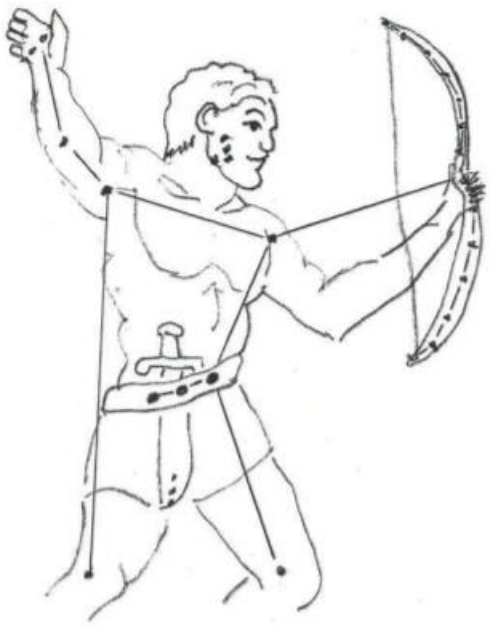
Queen Cassiopeia, wife of King Cepheus and mother of Andromeda, was very beautiful. She boasted that she was the most beautiful woman in the kingdom. As time went by, she began to say that she was the most beautiful woman in the world. Eventually, her boasting proclaimed that her beauty even exceeded that of the gods. Poseidon, the brother of Zeus and the god of the sea, took great offense at this statement, for he created the most beautiful beings ever in the form of his sea nymphs.

In his anger, he created a great sea monster, Cetus (also described as a great fish or whale), to ravage the seas, sinking ships, killing the sailors, and destroying towns and villages along the seacoast. This created great fear among the people of Cassiopeia's country. In an effort to stop this tremendous destruction, the people went to Poseidon and asked what could be done to stop this monster. Poseidon replied that if Cassiopeia would admit that his sea nymphs were indeed more beautiful than she, he would stop the monster. But Cassiopeia refused. The people asked Poseidon if there were any other way to stop the destruction. He replied that if the beautiful Andromeda, Cassiopeia's only daughter, were to be sacrificed to Cetus the destruction would stop. The people took Andromeda and chained her to a rock, which projected out into the sea to be sacrificed to Cetus. However, she was saved by Perseus, and Cetus was turned to stone.

Poseidon and his brother Zeus decreed that Cassiopeia be placed in the sky as a constellation, and as punishment for being so conceited about her looks, she would suffer the humiliating position of being upside down in the sky during the fall of the year when her constellation is best seen.

Constellation story from: http://www.tcoe.org/scicon/instructionalguide/constellations.pdf

Orion – The Great Hunter



With his great skill as a hunter, Orion provided meat each day for the gods' meals. One day, Artemis (Diana), the moon goddess and goddess of the hunt, asked if she could accompany Orion on his daily hunt. He readily agreed. The next day as they were hunting in the woods, they saw a deer. Orion carefully fitted an arrow to his bow and shot. So sure was his shot that the deer died instantly, which pleased Artemis greatly. At dinner that evening, Artemis told everyone, even Zeus, of Orion's great ability with the bow. All of the praise extremely pleased Orion, who vowed to impress Artemis even more the next day.

Arising at dawn, Orion proceeded again to the forest where he shot every animal he found. He then made a large pile of these animals near the door to Artemis' house. Then, knocking on her door, he asked her to come outside and see the great surprise he had for her. Upon seeing the great pile of dead animals, Artemis was horrified! For you see, Artemis was also the protector of animals and punished those who killed more than they could eat. In her anger, she stomped her foot on the ground and out of the dust came a great scorpion which stung Orion on the heel causing him to die in great pain. But in honor of his great service to the gods, Zeus placed his constellation in the sky.

Constellation story from: http://www.tcoe.org/scicon/instructionalguide/constellations.pdf

Sagittarius – The Archer

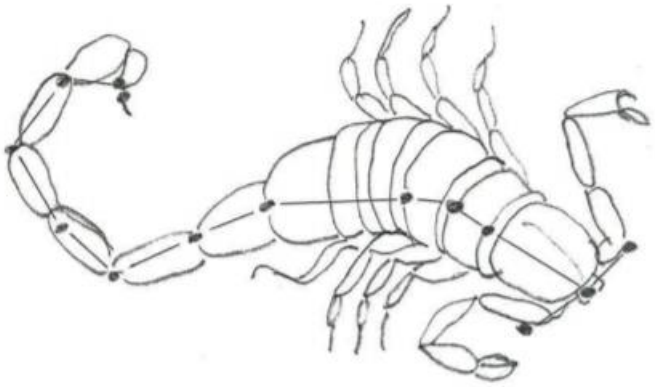
Sagittarius is usually described as a centaur, horse from the waist down and man above the waist. The constellation was placed in the night sky by Zeus to honor Chiron, the king of the centaurs.

Chiron had galloped into a battle where some bad centaurs were attacking Hercules, and a good centaur, Pholus. Hercules was defending Pholus from the bad centaurs by shooting poison-tipped arrows at them. Not knowing that Chiron was there, Hercules shot one of his poison-tipped arrows at him by mistake and hit him. When Chiron fell to the ground, all of the other centaurs galloped away.

Because he had been made immortal long before, Chiron did not die. He would have to live in horrible pain forever. Zeus took pity on him and ended Chiron's great pain by allowing him to die.

Constellation story from: http://www.tcoe.org/scicon/instructionalguide/constellations.pdf

Scorpio – The Scorpion

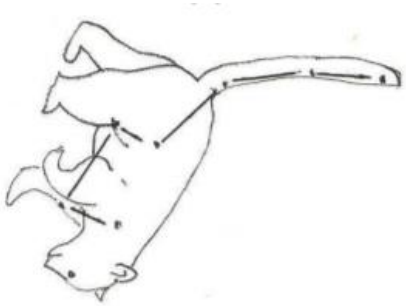


This is the famous Scorpion, which came up out of the ground and was commanded by Artemis to sting Orion, the mighty hunter, and caused him to die. That was the punishment Orion received because he had killed so many animals for no reason, except to try to impress her.

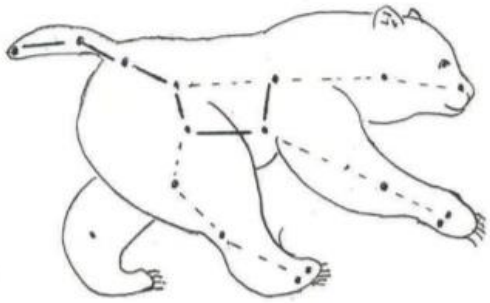
Scorpio was then placed into the sky on the opposite side of the world from Orion so as to avoid any further conflict. It was also placed in the sky to remind all of us that it is okay to kill animals for food, but it is wrong to kill them just for the fun of it.

Constellation story from: http://www.tcoe.org/scicon/instructionalguide/constellations.pdf

Ursa Major – The Big Bear (Dipper)
Ursa Minor – The Little Bear (Dipper)



Ursa Major is one of the oldest known constellations and has more named stars in it than any other constellation. It has been known by many names, but the form of the bear has become the most common, even though it's quite difficult to see this image in the stars.



In Greek mythology, Zeus had many human girlfriends, but his favorite was the beautiful nymph Callisto. His secret visits to earth to meet with her only added to Hera's jealousy and determination to get revenge against these women.

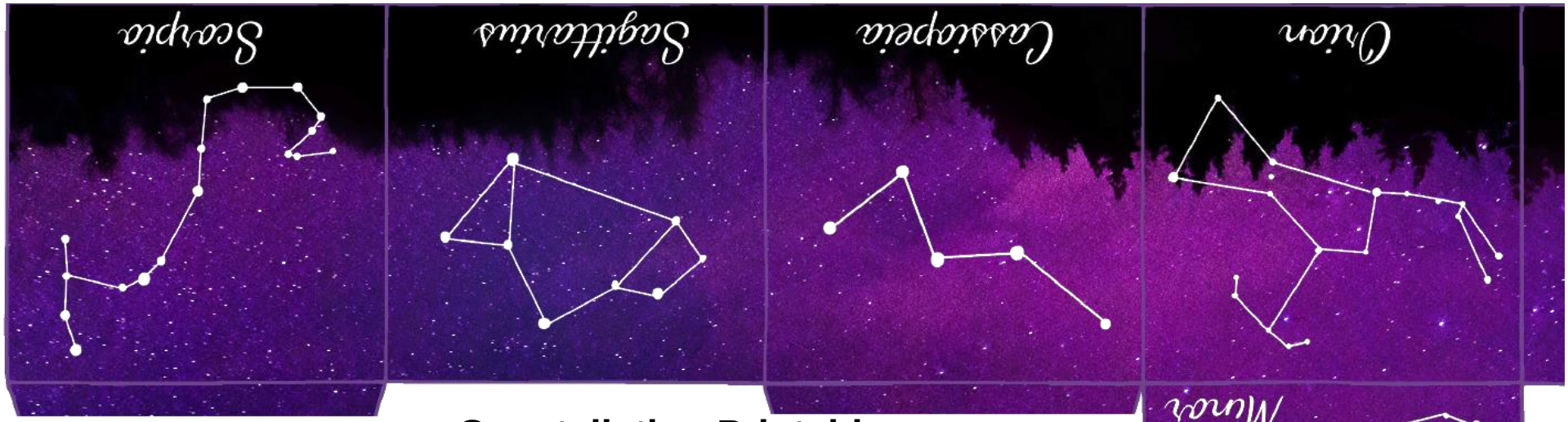
One day, as Zeus was walking through the forest with Callisto, he saw his wife Hera coming. Unable to hide Callisto in time, he turned her into a large brown bear. When Hera arrived, she saw only Zeus walking by himself through the forest. She looked around, searching for someone with Zeus, but saw only an old brown bear. She still did not trust Zeus and insisted that he return to Mount Olympus. Zeus did not want to go because he wanted to change his girlfriend Callisto back into her human form before leaving. But Hera insisted. So Zeus went with Hera, leaving Callisto as a large brown bear.

Unknown to Zeus, Arcas, Callisto's son who was a great hunter, was out in the woods hunting that day. As chance would have it, he saw this great big brown bear. He put an arrow to his bow, took careful aim, and shot that great bear through the heart. Right before his startled eyes, Arcas watched the bear as it died change back into the form of his mother Callisto with an arrow through her heart.

Arcas began to cry loudly for his mother and what he had done to her. When he realized that it was Zeus that had changed her into the bear, he grew even angrier. Zeus, fearing that Hera might hear the cries, went down to earth to try to appease Arcas. In order to hide what he had done, Zeus changed Callisto back into a bear and placed her form, as a constellation, into the northern sky as the Big Dipper. He then changed Arcas into the small bear (the Little Dipper).

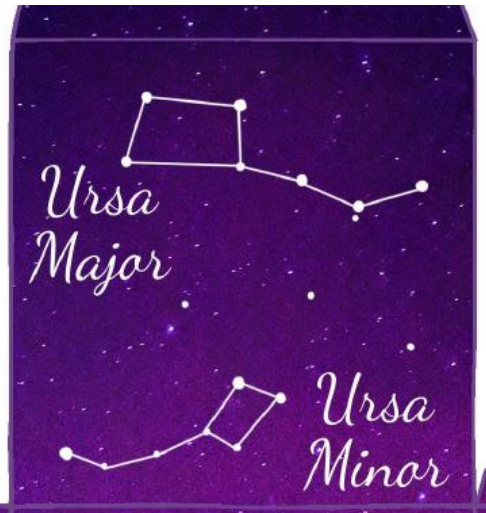
As Arcas was being placed into the sky, he turned to look at his mother Callisto (now the Big Dipper). That is why the Little Dipper is curved toward the Big Dipper, so that Arcas can watch over his mother Callisto for all eternity.

Constellation story from: http://www.tcoe.org/scicon/instructionalguide/constellations.pdf



Constellation Printable

- Best if printed in color on 8-mil poly paper but white cardstock in black and white works well too.
- Cut out each box.
- Cover the inside faces with electrical tape. Optional but recommended.
- Poke holes in the box for each of the stars using a pushpin. Make holes bigger and smaller as indicated by the size of the dot for each star.
- Fold along all the edges and tape the box together using the clearest transparent tape.
- Place it over a battery-powered tea light candle and view in a dark room.



Created by Hattifant for **Red Ted Art**