

Fifth Grade

Science Lessons



Next Generation Science Standard- 5th Grade Lessons

18 Weeks of Science Lessons that incorporate all of the NGSS standard for 5th Grade

**go to <http://5thgradenextgenerationscience.weebly.com/> to click the hyperlinks as you teach

The first week is setting up routines. It is longer than the others, for clarity.

Week 1

Supplies: Handouts; Quizlet Flashcards to send home on Monday. [About Engineering](#); plastic bags or light material, scissors, string, small objects like little action figures.

Student Objectives: Students will investigate what an engineer does. Students will practice being engineers and solve a problem using an engineering design process.

Standard(s): 5. ETS1.1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 5. ETS1.2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 5. ETS1.3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.;

Essential Question(s): What do engineers do? What kinds of engineers are there? Can you be an engineer?

Monday- Give pre-test. Grade and save for Friday. Tell students that we are going to learn what engineers do and practice being engineers this week. Pass out the Engineering Inquiry Booklets for each student. Tell students to take notes in their booklets, write down thoughts, and ideas throughout the video. [Play Video](#). Stop at 9:28. (be prepared to pause video to give students time to write) Give the class an extra 5 minutes after you stop the video to finish writing thoughts and ideas. Let them get into small groups to share what they discovered. (Sometimes student discussions take training. I use a timer and set it for small increments and facilitate when students don't talk by asking things like "Talk about what you noticed." etc. Let the students that didn't write ideas learn from their groups and fill in their booklets. They will need their booklets complete to refer to throughout the school year. Collect booklets. Introduce Quizlet Practice, (Sometimes I introduce the 1st one on the board and do the flash cards in teams. They find that even though they don't know them the first time, they quickly pick them up. It's a good way to teach good study habits that carry over into other subjects. Students work with a partner using the online flashcards. [About Engineering](#). Send home [printed flashcards](#) for students to study for test on Friday.

Tuesday- Pass out the Engineering Inquiry Booklets for each student. Tell students to continue to take notes throughout the video. [Play Video](#) from 9:28-20:26. Give the class an extra 5 minutes after you stop the video to finish writing their thoughts. Let them get into small groups to share what they discovered. Let the students that didn't have ideas learn from their groups and fill in their booklets. Students can work on Quizlet's Scatter. [About Engineering](#). Encourage them to try to beat each other's scores. This gives them an objective and they will throw themselves into it more.

Week 1 Continued...

Wednesday- Pass out the Engineering Inquiry Booklets for each student. Tell students to continue to take notes throughout the video. [Play Video](#) from 20:27. Stop at 27:36 to let students design a model of a robot and to label the variables. Have students get with a partner to compare solutions and discuss "other ideas" to modify. Play the video to the end. Give the students time to design a model of a treehouse and to label the variables. Let them get into small groups to compare how their models are similar and how they are different. Afterwards, debrief the class and ask them to share any ideas that they just loved. Students can work on Quizlet's Scatter. [About Engineering](#). There won't be as much time today. Encourage students to play Quizlet's Scatter at home.

Thursday- Explain that a Rube Goldberg Machine is a machine that makes a "chain reaction". Tell students that you want them to watch the short video and be able to explain to a partner what the chain reaction is in the video. [Play video](#). Go over the "Failing Forward" handout. Discuss and have students write down thoughts or notes. Pass out supplies and let students work on a parachute design with partners or groups. Debrief after first prototype. Ask questions. "What did you notice?" "What worked well?" "What didn't work well?" Talk to your partner about what you want to improve. Try a 2nd design. Test. Repeat debrief. Quizlet [Test Practice](#). (only matching and multiple choice should be check marked. Remind the class to study their flashcards for test tomorrow.

Friday- Show [video](#). Tell the class that not all problems are like designing and constructing a bridge to get in and out of San Francisco. What was the problem that the little girl had in this video? How did her brother solve her problem? Describe to your partner about a problem where you think that you used the engineer designing process. Do "My Reflection" handout. Give the class time to study the [flashcards](#), [scatter](#), or [practice test](#) on Quizlet. Give post-test. Give exit tickets. Pass out the pre-tests and go over with the post tests after grading. Collect and save Engineering Inquiry Booklets for later.

Week 2

Supplies: Handouts; 2 different colors of Post-its; chart paper; jars with lids, glow in the dark paint (Tulip is good); paint brushes, paint tray or paper to put paint on; glue; glitter; same and different sized flashlights; shoe boxes, cardboard, cardstock; scissors; glue.

Student Objectives: Students will support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.

Standard(s): 5. ESS1.1 Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.

Essential Question(s): How does the distance from Earth effect the apparent brightness of the sun and stars?

Monday- Today imprint science knowledge about stars. Tell students that we are going to be studying about stars this week. Pass out star study booklets. [Play video](#). Students take notes in their booklets. Collect for tomorrow. Do informational reading together. [How Bright is Bright](#). Explore online games with a partner. [Life Cycle of Stars](#), [Types of Stars](#), [Planetary Pairs](#). Do [I notice/I wonder chart](#). ([click for example](#)) Pass out two different colors of post-its. Post a chart paper that says "About Stars", "I noticed....", and "I wonder...". Have students write down one thing they noticed and one thing that they wonder about stars and initial their post-its. They read them as they put them up. Collect booklets.

Tuesday- Draw attention to the student's wonderings and noticing chart. Have post-its available. Tell students that they can add anything that they notice or wonder about today. Pass out booklets. [Play video](#). Add notes. Discuss handout about how objects look bigger if closer. (Disney castle and White House pics) Students will create [fairy glow jars](#). (3:06 Teacher can watch ahead of time. Students have instructions.) Ask students to share what they added to the chart at the end of the lesson. If time, have students play [Helios](#), where they can create nuclear fusion. Collect booklets.

Wednesday- Draw attention to student's wonderings and noticing chart. Have post-its available. Students anything they notice or wonder about today. Pass out booklets. Play [video 1](#). Notes in booklets. Play [video 2](#). Students take notes. Put students in groups. Have flashlights available for exploration. Dim lights. Give students time to explore with flashlights and fill out their Star Brightness Discovery pages. Each group presents diagrams to class. If you have a classroom elmo, this is very handy for this part. Students share what they added to chart. If time, students look through [Nasa's Gallery of Space Images](#) with a partner.

Thursday- Draw attention to the student's wonderings and noticing chart. Have post-its available. Students can add anything that they notice or wonder about today. Pass out handouts. Students create a model to demonstrate how stars closer appear brighter. With a partner, students practice presenting their model. Partner will fill out a "feedback form" from their handouts and they discuss them. Let students share if they added to the chart. Let them take their feedback form home so that they can practice their presentations for Friday. Options: You can use the feedback form/rubrics included or you can create a feedback form/rubric together, as class.

Friday- Project-based Assessment. Students present shoe box models and describe how they demonstrated that stars closer appear brighter. Tip: Teacher should check as they present to see if they work. If time, let students explore previous online activities/games/gallery. [Life Cycle of Stars](#), [Types of Stars](#), [Planetary Pairs](#), [Helios](#), [Nasa's Gallery of Space Images](#).

Week 3

****Supplies:** Handouts, Online Flashcards (for homework); String or yarn; 4 pieces of masking tape; sun sign; Earth sign; Choose 1) chalk; ruler/meter stick/yard stick; piece of duct tape; compass (download free compass apps on cell); data sheet or 2) an object (like a water bottle) to create shadows; butcher paper; duct tape; pencil; ruler/meter stick/yard stick; compass (download free compass apps on cell); data sheet.

Student Objectives: Students will represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Standard(s): 5. ESS1.2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Essential Question: How can you use data to show patterns of how shadows change? How can you use data to show patterns of the seasonal appearance of some stars in the night sky?

Monday- Give pretest. Pass out the "Seasons from a Tilted Axis" booklets. [Play video](#). Students take notes in booklets. Students can practice with a partner using the [online flashcards](#). Give students time to practice [Scatter](#). Send home [printed flashcards](#) for students to study for test on Friday. Collect booklets.

Tuesday- Pass out the booklets. [Play video](#) and students take notes. Be prepared to stop to let students write or discuss. Students will do the kinesthetic Reconstructing Earth Rotation, Revolution, and the Seasons Activity. Debrief. Ask students if they discovered anything interesting that they would like to share. Collect booklets. Play [Scatter](#).

Wednesday- Pass out the booklets. [Play video](#)-What do you think we are going to learn about today? [Play Video 2](#). Students take notes. Be prepared to stop to let students write or discuss. Explain. A time-lapse video shows time sped up. We can watch a whole day, sped up in just minutes to see small changes. [Play video 3](#). (1 min.) What did you notice in the time-lapse video? [Play video 4](#). Do the "Shadow Measurement Activity". If you do science in the afternoon, you might want to wait and start measurements in the morning. If you wait until the morning, students can work on [flashcards](#), [scatter](#), the [online practice test](#). Collect booklets.

Thursday- Pass out the booklets. Students will create a bar graphs. Graph 1 at [Rapid Tables](#). For graph 2, use the template. The directions are in booklets. Start next investigation. [Play video](#). Students take notes. Collect booklets.

Let students [research constellations](#) in their location. If time, let students study on Quizlet- [flashcards](#), [scatter](#), the [online practice test](#)- for tomorrow's test. Remind class to study their flashcards for homework.

Friday- Students will explore the following sites with a partner (to discuss and brainstorm ideas) to answer the "big question" in their booklet. [Reading informational](#), [constellation game](#), [viewing stars](#). Give post-test. Give exit tickets. Pass out the pre-tests and go over with the post tests after grading.

List of Formative and Summative Assessments

This is a list to simplify inputting grades into gradebook.

Week 1- Engineering and Design (1)

Pre-Test	Formative
Student Notes	Formative
My Reflection	Summative
Exit Ticket	Summative
Test	Summative

Week 2- Star Study

Pre-Test	Formative
Student Notes	Formative
Brightness of Star Investigation/Model	Formative
Presentation	Summative
Test	Summative

Week 3-Seasons from the Tilted Axis

Rotation, Revolution, Seasons Students Model	Formative
Shadow Investigation	Summative
Shadow Investigation Data	Summative
Exit Ticket	Summative

Week 4-Earth's Four Spheres

Pre-test	Formative
Volcano in a Cup	Formative
Diorama Presentation	Summative

Week 5- Earth's Four Spheres

Ecosystem in a Bottle Investigation	Summative
Ecosystem in a Bottle Presentation	Summative
Test	Summative

Week 6 – Where on the World (water)

Pre-Test	Formative
Graph	Summative
Story Rubric	Formative
Edible Aquifer Investigation	Summative
Edible Aquifer Model	Summative
Exit Ticket	Summative
Test	Summative

Week 7 – Communities Using Science to Solve Problems

PowerPoint Notes and Planning Organizers	Formative
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Week 8- Communities Using Science to Solve Problems

PowerPoint & Presentations Rubric	Summative
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Week 9- Engineering and Design 2

Bridge Investigation Plans	Formative
Trip Trap, Trip Trap, Trip Trap Presentations	Summative
Exit Ticket	Summative

Week 10 – Fun-Sized Matter

Pre-test	Formative
Atomic Structure Worksheet	Formative
3D Model of an Atom	Summative
Scavenger Hunt Gallery Walk	Summative
Exit Ticket	Summative
Test	Summative

Week 11 – Weight Doesn't Matter

Ice vs. Water Matter Investigation	Formative
Rice Krispy Weight Investigation	Formative
Bar Graph	Summative
Exit Ticket	Summative

Week 12 – Mystery Matter

Student Anchor Charts	Summative
Mystery Matter Data Collection	Formative
Exit Ticket	Summative

Week 13 – Time for a Change (chemical changes)

Magic Mud Infestation	Formative
Ice Cream Investigation	Formative
Slime Investigation	Formative
Kinetic Sand Investigation	Formative
Magic Mud Part 2 Investigation	Formative
Elephant Toothpaste Investigation	Formative
Exit Ticket	Summative

Week 14 – What Goes Up Must Come Down

Pre-Test	Formative
Hack the Stack Investigation	Summative
Rocket Racer Investigation	Summative
Anchor Charts	Summative
Test	Summative

Week 15 – Engineer and Design (2)

Do the Humpty Dance Investigation Plans	Formative
Do the Humpty Dance Group Presentations	Summative

Week 16 – Composing Decomposition

Pre-test	Formative
Composing Decomposition Observational Logs	Formative
Powtoon Rubric	Summative
Test	Summative

Week 17 – Power Plant: Where Plants Get their Energy

Pre-Test	Formative
Power Plant Investigation Logs	Formative
2 D Model Plants and Photosynthesis	Summative
Test	Summative

Week 18 – Out Came the Sun

Pre-test	Formative
2 D Model Sun's Energy to Earth	Formative
Animal Classification Chart	Summative
Test	Summative

About Ordering Supplies

I have broken the list down into categories. My suggestion would be to get a tub and have all of your science supplies in one spot to simplify your life. I have broken the supplies down into three ways. 1. Week by week; 2. One Page at a Glance; 3) Checklist.

It is difficult for me to say the quantity when building your tub supplies. I don't know how many students your class has. I also always get extra. (just in case)

There is a checklist to make notes on. This can help you plan for the second year. You can make notes about quantity or highlight things that need replaced each year.

Many of the items will need replaced year to year. Some items will need replaced, but they might last several years. Any good science tub needs refilled each year.

There is a parent note to ask for students to bring in items. I would send it out at the beginning of the year. Most parents will try to quickly get the items in. Some students will bring in "extra" if you tell the students. This helps for the students that won't bring in anything.

Supplies Needed-A Week by Week Breakdown

Supplies at a Glance

Week 1 Handouts; Flashcards; plastic bags or light material, scissors, string, small objects like little action figures.

Week 2 Handouts; 2 different colors of Post-Its; chart paper; jars with lids, glow in the dark paint (Tulip); paint brushes, paint tray or paper to put paint on; glue; glitter; same and different sized flashlights; shoe boxes, cardboard, cardstock; scissors

Week 3 Handouts, Flashcards; String/yarn; 4 pieces of masking tape; sun sign; Earth sign; Choose 1) chalk; ruler/meter stick/yard stick; piece of duct tape; compass; or 2) an object (like a water bottle) to create shadows; butcher paper; duct tape; pencil; ruler/meter stick/yard stick; compass; data sheet.

Week 4 Handouts; Flashcards; shoeboxes; butcher paper (different colors), construction paper (different colors) scissors, glue, markers; craft supplies (pipe cleaners, cotton, pom poms, tissue paper, glitter, etc. Whatever you usually use or have on hand); candle wax; sand; electric burner; glass beaker; cup; water

Week 5 Handouts; Flashcards from last week; empty 2-liter bottle; scissors; aquarium gravel, stones, or pebbles; potting soil or topsoil; seeds or plants; clear packing tape to seal bottle; sun.

Week 6 Handouts (If you do writing on computers, then you might opt not to print out the writing paper for the booklets for Tuesday and Wednesday.); Flashcards; plastic cups, ice cubes, chocolate ice cream, milk, food coloring, sprinkles, straw.

Week 7 Handouts; Microsoft PowerPoint

Week 8 Handouts; Microsoft PowerPoint, index cards.

Week 9 Handouts; Flashcards. [About Engineering](#). About 4000 wooden craft sticks/STEM project (buy in bulk 1000. 200 per group for 2 days); craft glue (hot glue works best.... craft glue is safer); student textbooks to place on top of bridges.

Week 10 Handouts; Flashcards; Print out [Element BINGO](#) cards (optional for Tuesday); red, blue, and green mini-circles in Ziploc sandwich bags. (use construction paper and hole punch- do it ahead of time, or the class can do it); glue stick; shoestring licorice; red gum drops; green gum drops; white chocolate chips; thin pretzel sticks; paper plates; container of frosting (for glue)

Week 11 Handouts; ice cubes; balance scales (1 per group); sandwich bags (1 per group-labeled with group number or name); Microwave oven; each student will need a microwavable coffee cup or mug; a paper plate; ½ TBSP butter; 4 lg. marshmallows; a spoon; 1 cup of rice krispy cereal

Week 12 Handouts, mystery box, student's objects; meter sticks; rulers.; five mystery objects for Monday (suggest: book/hardness; playdoh/malleable; conductivity/small pan; magnetic/coins; desk/measurement

Week 13 Handouts; Large bag of russet potatoes; food processor or knife and cutting board; 2 large mixing bowls; hot water; strainer; spoon to stir; large jar with a lid; fork; sugar; milk; heavy whipping cream; vanilla extract (or other flavoring); salt; ice; 1 gallon-sized Ziploc bags sandwich Ziploc bags; Glue (white, clear or gel); small box Borax; Water; glitter, food coloring; measuring cups; measuring spoons; spatula; extra slime from Tuesday's investigation; paper plates; baby oil; water; dye; potato powder from part 1; tonic water; black light; spatula; paper bags or butcher paper to put down for work area; 3% Hydrogen peroxide, yeast (catalyst); dish soap; empty bottles (tall skinny); warm water. Yeast (catalyst), paper funnel; powdered sugar; baking soda; alcohol; dry sand; tin pie pan; lighter.

Week 14 Handouts; Flashcards; 6 checkers per group; (Each student)- a piece of paper, scissors, 4 large lifesavers, 3 straws, 1 balloon, 1 rubber band, and 5 pennies; glue; and can share masking tape

Week 15 Handouts; plastic heavy-duty trash bag; plastic sandwich bags; string; scissors; hole punch; eggs

Week 16 Handouts; Flashcards; 3 clear jars with lids (put a hole in the top of each lid with a hammer and nail); newspaper; plastic; and banana peel, orange peel, or apple core; labels; soil

Week 17 Handouts; Flashcards; Student investigation form, lima beans, sandwich bags, paper towels, water; Tablespoon; masking tape.

Week 18 Handouts; Flashcards

Tub Ordering Supply List

Supplies at a Glance

** The week you'll need this item is in the parenthesis behind item.

One Time Purchases

Small objects like action figures (1)
Different sized flashlights (dollar stores) (2)
Electric burner (4)
Glass beaker (4)
Measuring cups (4) (13)
Measuring spoons (13) (17)
spatula (13)
black light (13)
lighter (13)
[Element BINGO cards](#) (free printable) (10)
Balance scales (11)
Spoon (11) (13)
2 large mixing bowls (13)
Baby oil (13)
6 checkers per group (14)

Will need to restock Each School Year

Glow in the dark paint (tulip paint) (2)
Seeds or plants (5)
Chocolate ice cream (6)
Milk (can check with cafeteria) (6) (13)
Sprinkles (6)
butter (11)
marshmallows (11)
rice krispy cereal (11)
russet potatoes (13)
sugar (13)
heavy whipping cream (13)
ice (13)
eggs (15)
4000 popsicle sticks (a stem project) buy bulk 1000 ct. (9)

Misc. items

String (1) (3) (15)	Cutting board (13)
Cardboard (2)	Strainer (13)
duct tape (3)	Large jar with lid (13)
compass (or online app) (3)	Borax detergent (13)
electric burner (4)	Hydrogen peroxide (13)
glass beaker (not break with heat) (4)	Dish soap (13)
candle wax (4)	Powdered sugar (13)
sun sign (in document) (3)	Baking soda (13)
Earth sign (in document) (3)	alcohol (13)
Object (like a water bottle) (3)	pennies (14)
Dry Sand (4) (13)	newspaper (16)
Food coloring (6) (13)	orange peel/banana peel/ apple core (16)
Straw (6) (14)	soil (16)
Knife (13)	lima beans (17)

Students Will Bring in *Parent note attached

Sandwich bags (1) (10) (11) (13) (15) (16) (17)
Jars with lids whole class (2)
Shoebboxes (2) (4)
Empty two-liter bottle (5)
Aquarium rocks (5)
Stones (5)
Potting soil (5)
Plastic cups (6)
Red gum drops (10)
Green gum drops (10)
White chocolate chips (10)
Thin pretzel sticks (10)
Paper plates (10) (11) (13)
frosting (10)
coffee cup/mug (11)
mystery object (12)
vanilla extract (13)
salt (13)
gallon zip lock bags (13)
tonic water (13)
yeast (13)
tall skinny empty plastic bottles (13)
tin pie pan (13)
Large lifesavers (14)
Rubber band (14)
Heavy duty trash bags (14)
3 large clear jars with lids (same size) (16)
Paper towels (17)

Typical Classroom Supplies

Scissors (1) (5) (15)	pencils (3)
Post-Its different colors (2)	butcher paper (3) (4) (13)
Chart paper (2)	construction paper (4)
Paint brushes (2)	markers (4)
Paint trays (2)	pipe cleaners (optional) (4)
Glitter (2) (4) (13)	cotton (optional) (4)
Cardstock (2)	pom-poms (optional) (4)
Glue (2) (4) (13) (14)	tissue paper (optional) (4)
Yarn (3)	clear packing tape (5)
masking tape (3) (14)	hole puncher (10) (15)
chalk (3)	glue stick (10)
ruler (3)	paper (14)
meter stick/yard stick (3) (12)	

Checklist for Supplies

** The week you'll need this item is in the parenthesis behind item.

One Time Purchases

- _____ Small objects like action figures (1)
- _____ Different sized flashlights (dollar stores) (2)
- _____ Electric burner (4)
- _____ Glass beaker (4)
- _____ Measuring cups (4) (13)
- _____ Measuring spoons (13) (17)
- _____ spatula (13)
- _____ black light (13)
- _____ lighter (13)
- _____ [Element BINGO](#) cards (free printable) (10)
- _____ Balance scales (11)
- _____ Spoon (11) (13)
- _____ 2 large mixing bowls (13)
- _____ Baby oil (13)
- _____ 6 checkers per group (14)

Will Need to Restock Each School Year

- _____ Glow in the dark paint (tulip paint) (2)
- _____ Seeds or plants (5)
- _____ Chocolate ice cream (6)
- _____ Milk (can check with cafeteria) (6) (13)
- _____ Sprinkles (6)
- _____ butter (11)
- _____ marshmallows (11)
- _____ rice krispy cereal (11)
- _____ russet potatoes (13)
- _____ sugar (13)
- _____ heavy whipping cream (13)
- _____ ice (13)
- _____ eggs (15)
- _____ 4000 popsicle sticks (a stem project) buy bulk 1000 ct. (9)

Misc. Items

- _____ String (1) (3) (15)
- _____ Cardboard (2)
- _____ duct tape (3)
- _____ compass (or online app) (3)
- _____ electric burner (4)
- _____ glass beaker (not break with heat) (4)
- _____ candle wax (4)
- _____ sun sign (in document) (3)
- _____ Earth sign (in document) (3)
- _____ Object (like a water bottle) (3)
- _____ Dry Sand (4) (13)
- _____ Food coloring (6) (13)
- _____ Straw (6) (14)
- _____ Knife (13)

Typical Classroom Supplies

- _____ Scissors (1) (5) (15)
- _____ Post-Its different colors (2)
- _____ Chart paper (2)
- _____ Paint brushes (2)
- _____ Paint trays (2)
- _____ Glitter (2) (4) (13)
- _____ Cardstock (2)
- _____ Glue (2) (4) (13) (14)
- _____ Yarn (3)
- _____ masking tape (3) (14)
- _____ chalk (3)
- _____ ruler (3)
- _____ meter stick/yard stick (3) (12)
- _____ pencils (3)
- _____ butcher paper (3) (4) (13)
- _____ construction paper (4)
- _____ markers (4)
- _____ pipe cleaners (optional) (4)
- _____ cotton (optional) (4)
- _____ pom-poms (optional) (4)
- _____ tissue paper (optional) (4)
- _____ clear packing tape (5)
- _____ hole puncher (10) (15)
- _____ glue stick (10)
- _____ paper (14)
- _____ Cutting board (13)
- _____ Strainer (13)
- _____ Large jar with lid (13)
- _____ Borax detergent (13)
- _____ Hydrogen peroxide (13)
- _____ Dish soap (13)
- _____ Powdered sugar (13)
- _____ Baking soda (13)
- _____ alcohol (13)
- _____ pennies (14)
- _____ newspaper (16)
- _____ orange peel/banana peel/ apple core (16)
- _____ soil (16)
- _____ lima beans (17)

Checklist for Supplies page 2

Students Will Bring in *Parent note attached

- _____ Sandwich bags (1) (10) (11) (13) (15) (16) (17)
- _____ Jars with lids whole class (2)
- _____ Shoeboxes (2) (4)
- _____ Empty two-liter bottle (5)
- _____ Aquarium rocks (5)
- _____ Stones (5)
- _____ Potting soil (5)
- _____ Plastic cups (6)
- _____ Red gum drops (10)
- _____ Green gum drops (10)
- _____ White chocolate chips (10)
- _____ Thin pretzel sticks (10)
- _____ Paper plates (10) (11) (13)
- _____ frosting (10)
- _____ coffee cup/mug (11)
- _____ mystery object (12)
- _____ vanilla extract (13)
- _____ salt (13)
- _____ gallon zip lock bags (13)
- _____ tonic water (13)
- _____ yeast (13)
- _____ tall skinny empty plastic bottles (13)
- _____ tin pie pan (13)
- _____ Large lifesavers (14)
- _____ Rubber band (14)
- _____ Heavy duty trash bags (14)
- _____ 3 large clear jars with lids (same size (16)
- _____ Paper towels (17)

Notes:

Dear Parents,

I have planned so many different fun and exciting science experiments, activities, projects, and investigations planned this year. From biome dioramas and edible atom models to chemical changes magical mud.

For science classes, to make these wonderful discoveries happen, I'm asking in the next 2 weeks for your child to bring in:

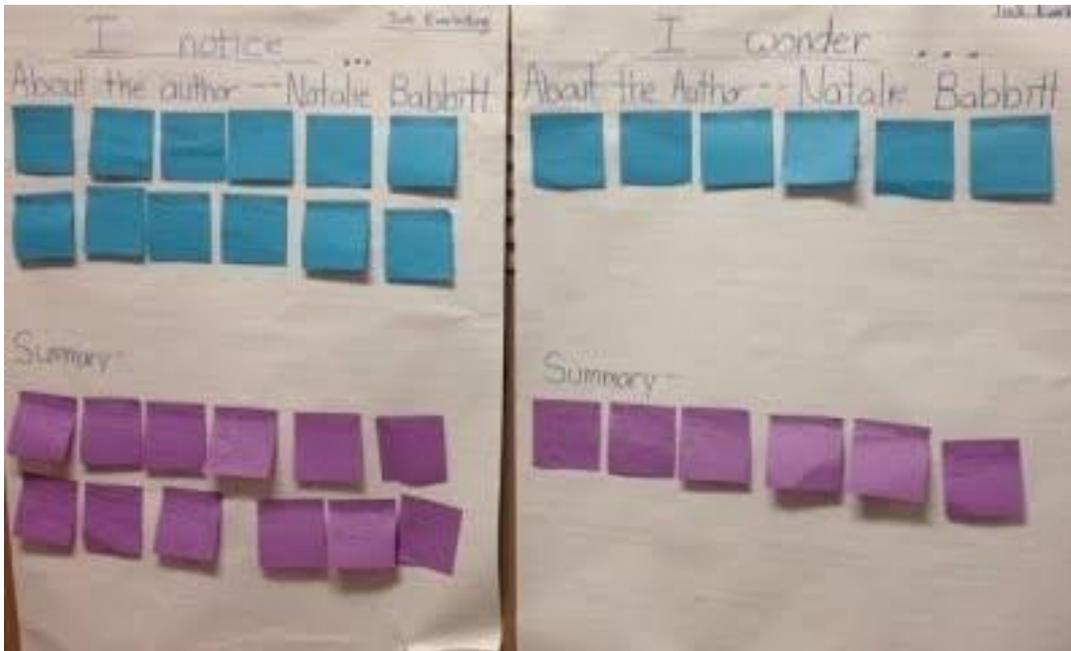
- jars with lids (extras appreciated)
- 2 shoeboxes (extras appreciated)
- an empty 2-liter bottle (extras appreciated)
- a small bag of small stones

Later this year, you will get a note asking for

- a mystery object (week 9—wait to find out about the properties)
- a coffee cup (week 11—will send back home after project)

Through the school year, many parents ask if there's anything that they can contribute to the classroom. Here is a list of other things that we need to do all of our investigations. If you would like to contribute by sending one or two of these, it will help our class.

- | | | |
|-------------------------|-----------------------------|--|
| ● sandwich bags | ● Paper plates | ● bottles |
| ● Aquarium rocks | ● frosting | ● tin pie pan |
| ● Stones | ● mystery object | ● Large lifesavers |
| ● Potting soil | ● vanilla extract | ● Rubber band |
| ● Plastic cups | ● salt | ● Heavy duty trash bags |
| ● Red gum drops | ● gallon zip lock bags | ● 3 large clear jars with lids (same size) |
| ● Green gum drops | ● tonic water | ● paper towels |
| ● White chocolate chips | ● Yeast | ● Clorox Wipes |
| ● Thin pretzel sticks | ● tall skinny empty plastic | |



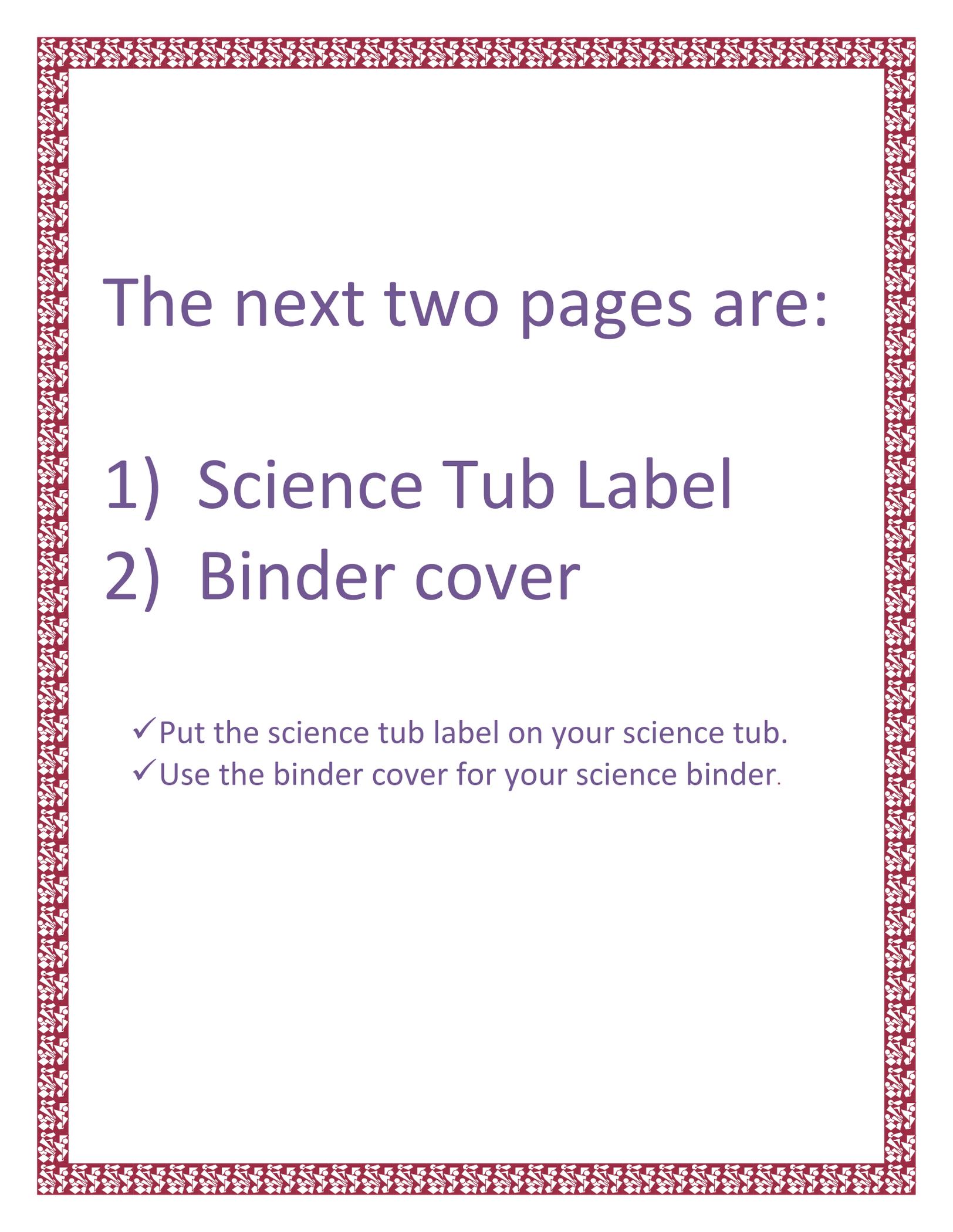
This a sample from Week 2.

If you like this practice, you can use it for any week. I use it for reading and social studies, as well.

Close Read with Post-Its (steps)

1. Hang up chart paper.
2. Pass out Post-its (or have available)
3. Students write things they “notice” or “wonder”
4. Go around the room and have students share one of their thoughts on their post-its.
5. Students post them under “I Wonder...” or “I Noticed....”

Note: Great for brainstorming, getting students to delve deeper into non-informational text, getting students active in learning, helping students that don't generate as many ideas, organizing thoughts, reviewing ideas, non-threatening way to get everyone to participate, sharing, speaking, writing, differentiating, engaging.



The next two pages are:

- 1) Science Tub Label
- 2) Binder cover

- ✓ Put the science tub label on your science tub.
- ✓ Use the binder cover for your science binder.

Fifth Grade Science

Making Science Fun

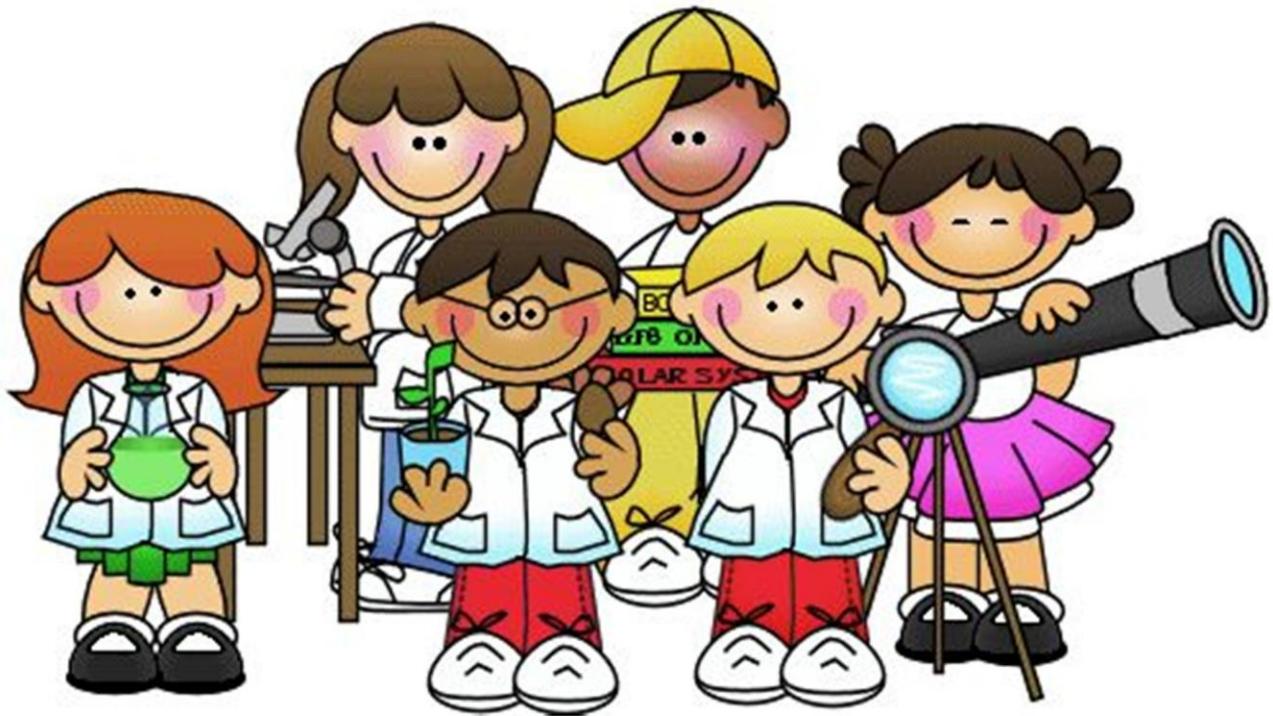
18 Weeks of Interactive, Hands-On, Easy to Implement Lessons, All Inclusive



Science Lessons For Fifth Grade!

Making Science Fun

18 Weeks of Interactive, Hands-On, Easy to Implement Lessons, All Inclusive



Next Generation Science Standards

Fifth Grade

Engineering Design

- 5.ETS1.1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

- 5.ETS1.2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

- 5.ETS1.3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Next Generation Science Standards

Fifth Grade

Earth and Space Science

Earth's Place in the Universe

- 5.ESS1.1** Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.
- 5.ESS1.2** Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Earth's Systems

- 5.ESS2.1** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- 5.ESS2.2** Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

Earth and Human Activity

- 5.ESS3.1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Next Generation Science Standards

Fifth Grade

Life Science

Molecules to Organisms: Structures and Processes

5.LS1.1 Support an argument that plants get the materials they need for growth chiefly from air and water.

Ecosystems: Interactions, Energy, and Dynamics

5.LS2.1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
[Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.].

Next Generation Science Standards

Fifth Grade

Physical Science

Matter and Its Interactions

- 5.PS1.1** Develop a model to describe that matter is made of particles too small to be seen.
- 5.PS1.2** Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
- 5.PS1.3** Make observations and measurements to identify materials based on their properties.
- 5.PS1.4** Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Motion and Stability: Forces and Interactions

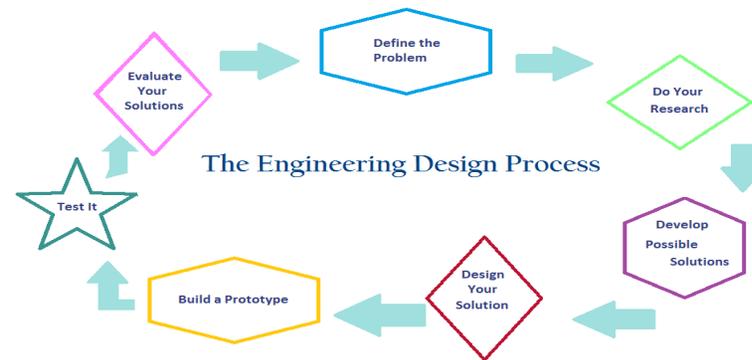
- 5.PS2.1** Support an argument that the gravitational force exerted by Earth on objects is directed down.

Energy

- 5.PS3.1** Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Name _____

Engineering and Design Pre-test/Post Test



Matching questions: Read the term on the left and write the letter that best describes it.

<u>Term</u>	<u>Definition</u>
1. _____ testing prototype	a. This is the step in the engineer design process where you need to identify your success criteria or checklist.
2. _____ engineers	b. When someone learns from their mistakes and keeps trying.
3. _____ design your solution	c. This is the step in the engineer design process where you determine if the prototype met the success criteria. This step will be repeated until there is success.
4. _____ failing forward	d. This is the first step in the engineer design process.
5. _____ define the problem	e. People who design and build things to solve problems.

Multiple choice questions: Read the description and shade in the bubble of the term that the description describes.

1. A condition or value that can be changed.

- variables
- criteria
- prototype
- engineers

2. This is the step in the engineer design process where you brainstorm ideas that could solve the problem.

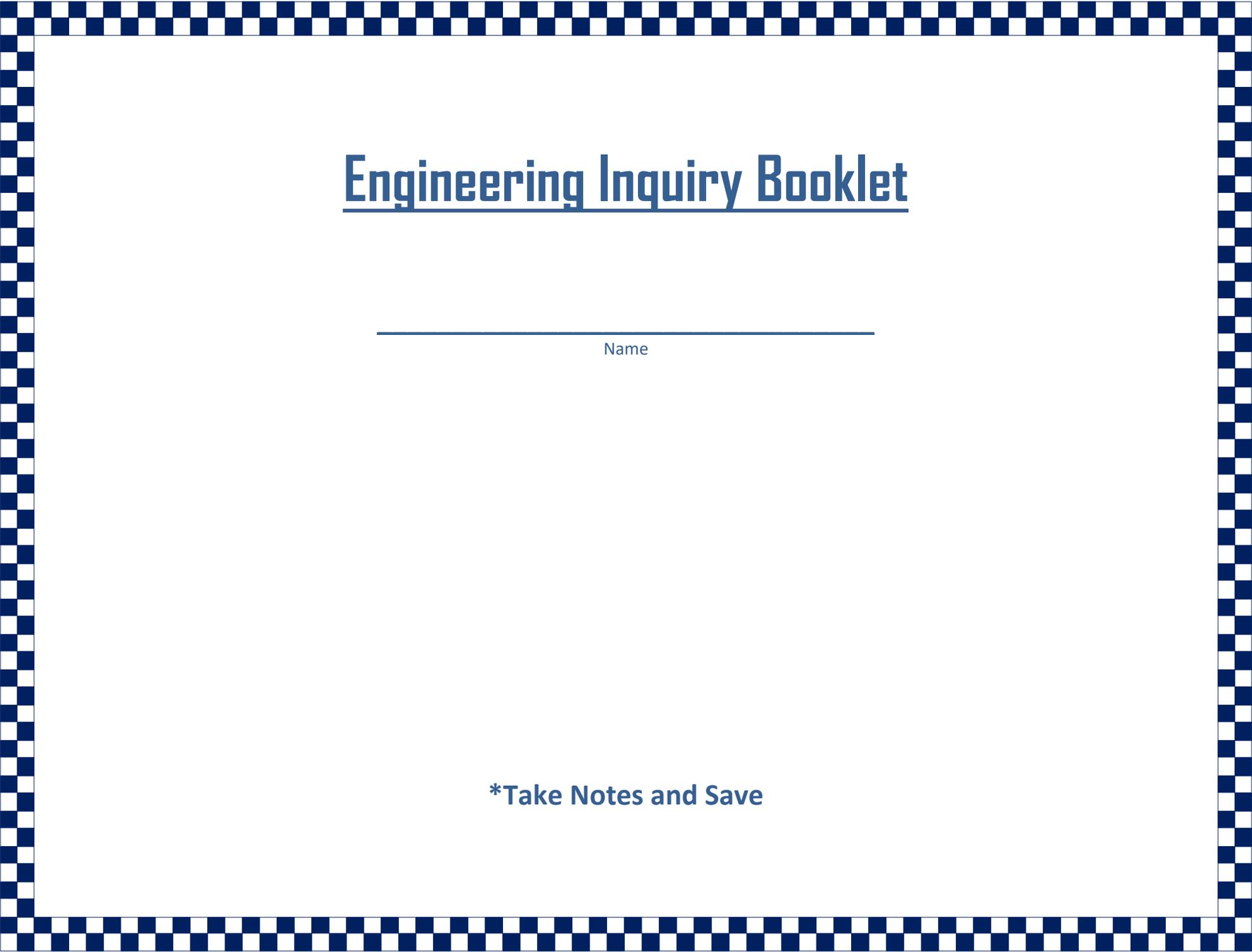
- define the problem
- design your solution
- develop possible solutions
- variables

3. The design or model to be tested.

- engineers
- criteria
- variables
- prototype

4. The standards that help engineers measure how well their design does its job.

- engineers
- criteria
- prototype
- variables

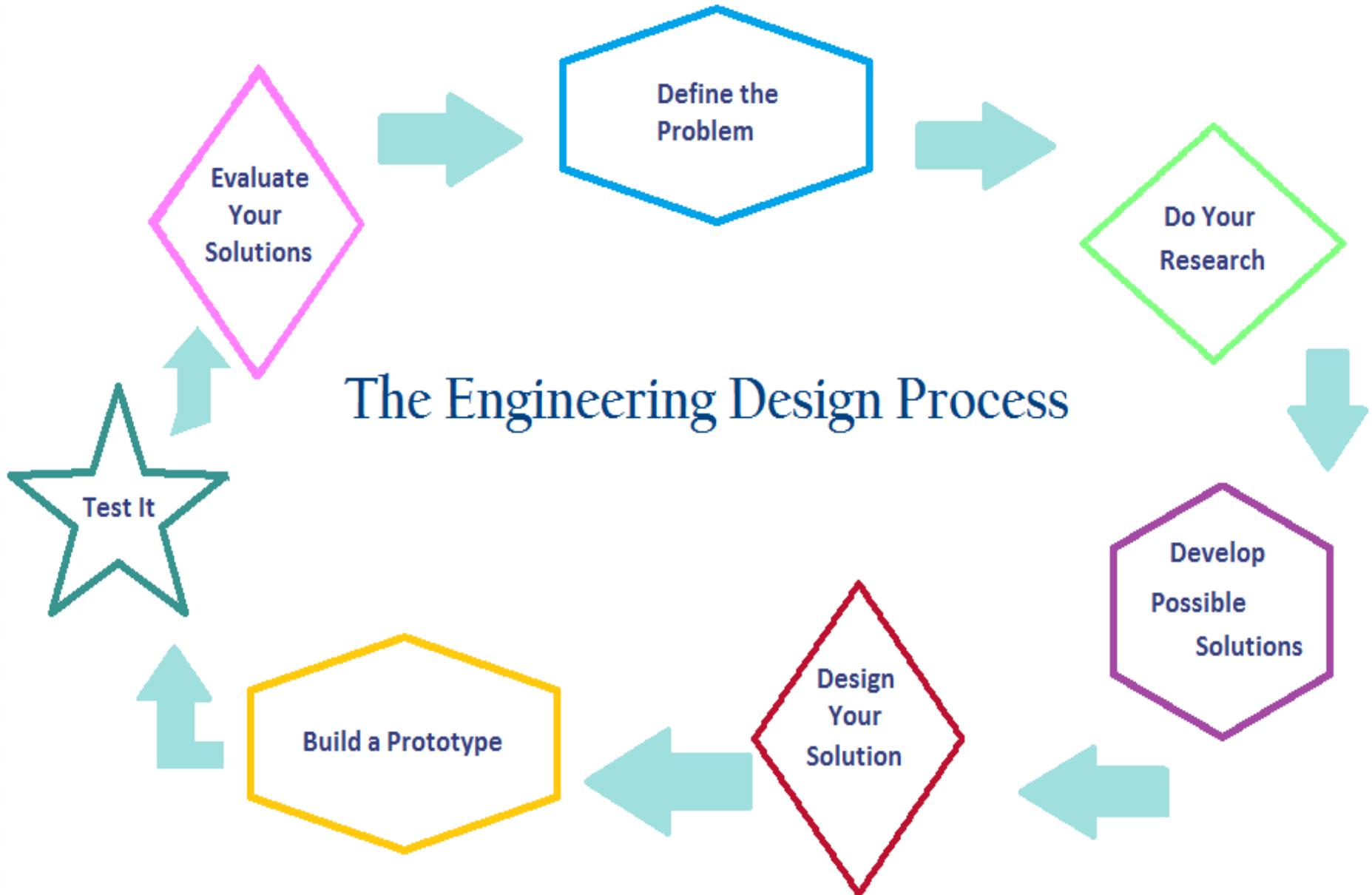
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Engineering Inquiry Booklet

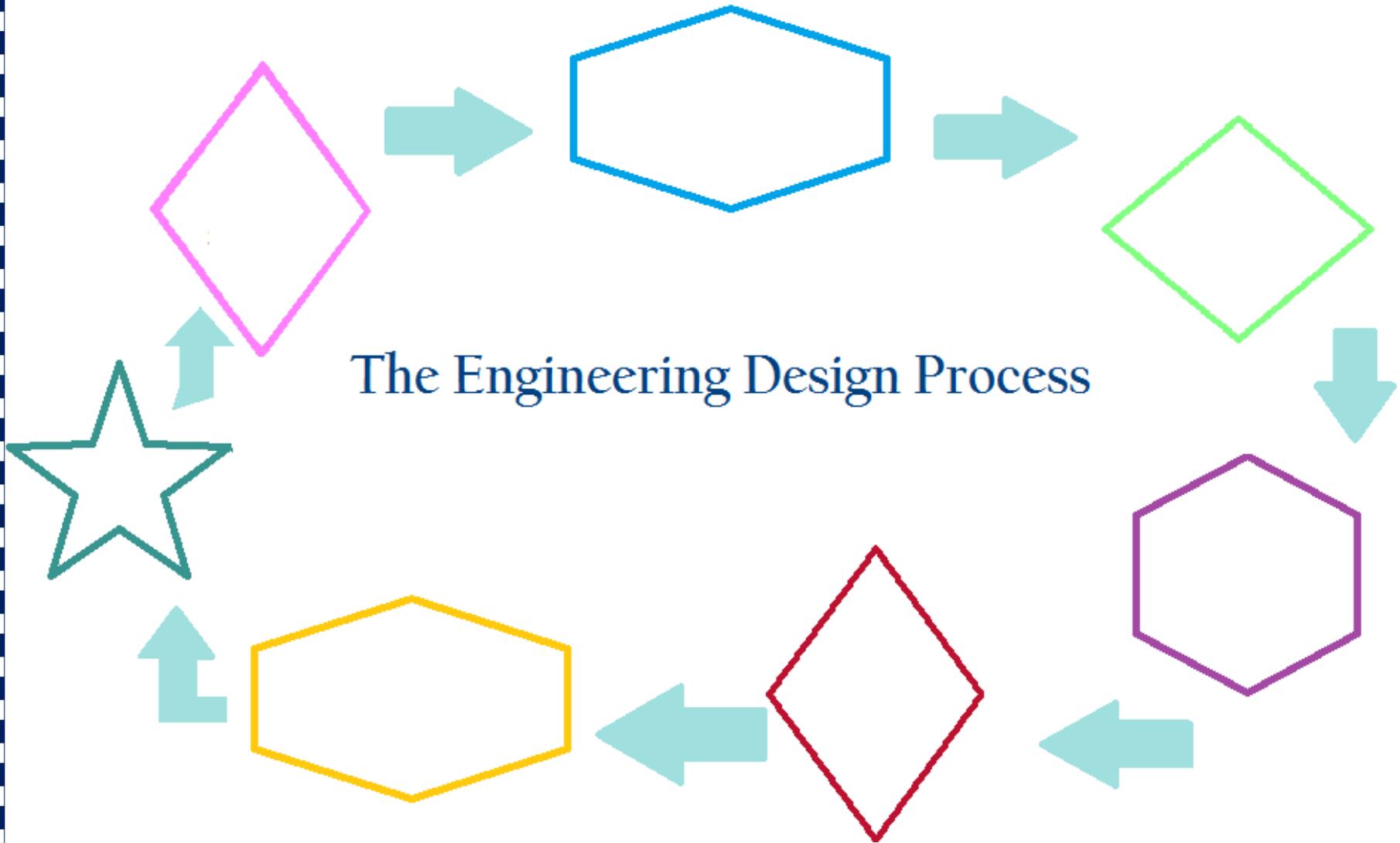
Name

***Take Notes and Save**

The Engineering Process



Create your Own Engineering Design Process
Use Words Meaningful to You



The Engineering Design Process

This week we are going to learn what engineers are and practice what engineers do.
Take notes from the video and write your own thoughts and ideas.
It goes fast, so be prepared to write fast. Stop at 9:28.

What is an **engineer**?

What are the three questions that engineers try to solve?

1.

2.

3.



Continue taking notes, your thoughts, and your ideas. Stop at 9:28.

What did you notice about these items from the video?

The Golden Gate Bridge:

Henry Ford's Model T-Ford:

Marissa Meyer:

Alexander Graham Bell:

Alfred Nobel:

Why didn't we need aerospace engineers in the 1800's?

What do you think engineers can't be afraid of in order to do their jobs?

What are engineers and what do engineers do.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Start at 9:28. Stop at 20:26.

The first step is to **DEFINE a PROBLEM.** Write down kinds of problems.

How does an engineer define a problem?

What are some problems that have been or can be solved by engineers?

What does a good solution have?

Continue taking notes, your thoughts, and your ideas. Stop at 20:26.

What is identifying the criteria?

Variables are conditions or values that can be changed. There are two kinds of variables.

Variables that we can change (list some examples)

Variables that we cannot change (list

some examples)

Name as many "what ifs" that you can think of off the top of your head.

What are engineers and what do engineers do.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Start at 20:27. Finish watching the rest of the video.

Why do we identify variables?

What are the two variables that can be changed in the "marshmallow game"?

1.

2.

Why do we change only one variable at a time?

It goes fast, so be prepared to write fast. Start at 20:27. Finish watching the rest of the video.

Define the Problem: The problem is to rescue the cell phone from the sewer.

Consider the solutions: 1) Rope to lower self into the sewer.

2) Use a fishing pole to fish out the cell phone.

3) Build a robot.

Design Solution: The robot needs to be able to fly, be remote controlled, have a camera, and have a suction cup.

Identify the Variables:

Fixed Variables: sewer depth, phone size, phone weight

Variables: propellers, suction cup, camera

Challenge: Can you come up with your own solution? What would your robot look like?

My robot would look like this:

(Design and draw a model of your robot and label the variables.)



It goes fast, so be prepared to write fast. Start at 20:27. Finish watching the rest of the video.

Define the Problem: I need a secluded place so I can have privacy.

Consider the solutions: 1) Box

2) Change existing space like my room.

3) Architect a treehouse.

Design Solution: The treehouse needs to have a drop down rope ladder, window, blankets, and space.

Identify the Variables

Fixed Variables: size of the tree

Variables: weight of the treehouse, number and size of blankets, noise that I make for number of blankets.

Challenge: What would your treehouse look like? How would it meet success criteria and navigate the variables?

My treehouse would look like this: (Design and draw a model of your treehouse and label the variables.)



Failing Forward!

Prototype After Prototype After Prototype After.....Prototype!

Discuss-Write notes or thoughts.

What do you think it means to “fail forward”?

Turn to a partner and talk about how you have “failed forward” and how it helped you.

Read together.

Scientists, engineers, architects, and other great problem solvers aren't afraid of failing forward. People who are afraid to fail forward become afraid to try things. The best inventions probably took thousands of prototypes or “back to the drawing boards”.

As successful scientists, engineers, and problem solvers, we will be brainstorming, designing models, building prototypes, and testing over and over again. Each time we test a prototype or talk to another person that did something different than us, we get brilliant ideas on how to improve our prototypes. It never ends. Apple keeps improving their iphones. Iphone 6, Iphone 6S, and so on. Pixar and Google are cutting edge companies where their engineers or designers talk and brainstorm ideas and their ideas get better and better the more they collaborate, or work together. We, as consumers, benefit from the products that they keep putting out and the prototypes that they are constantly improving.

How many failures did Audri think he would have?

How many failures did Audri have?

Do you think Audri is afraid of failures? Why or Why not?

Design and Test a Parachute

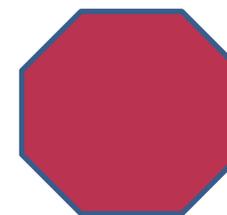
Let's try being engineers!

Student objective: We are going to learn about air resistance while we try using the "Engineer Design Process". We are going to design cool parachutes that can fall slowly to the ground. We will test it and make modifications to our prototypes and document our trials.

Supplies: A plastic bag or light material; Scissors; String; A small object to act as the weight, like a small action figure.

Steps:

1. Cut out a large square from your plastic bag or material.
2. Trim the edges so it looks like an octagon (an eight-sided shape).
3. Cut a small whole near the edge of each side.
4. Attach 8 pieces of string of the same length to each of the holes.
5. Tie the pieces of string to the object you are using as a weight.
6. Use a chair or find a high spot to drop your parachute and test how well it worked, remember that you want it to drop as slow as possible.



Criteria

Parachute will descend slowly to the ground, giving your figure/weight a comfortable landing.

When you release the parachute, the weight will pull down on the strings and open up a large surface area of material that uses air resistance to slow it down.

Design and Test a Parachute

Let's try being engineers!

Record Findings:

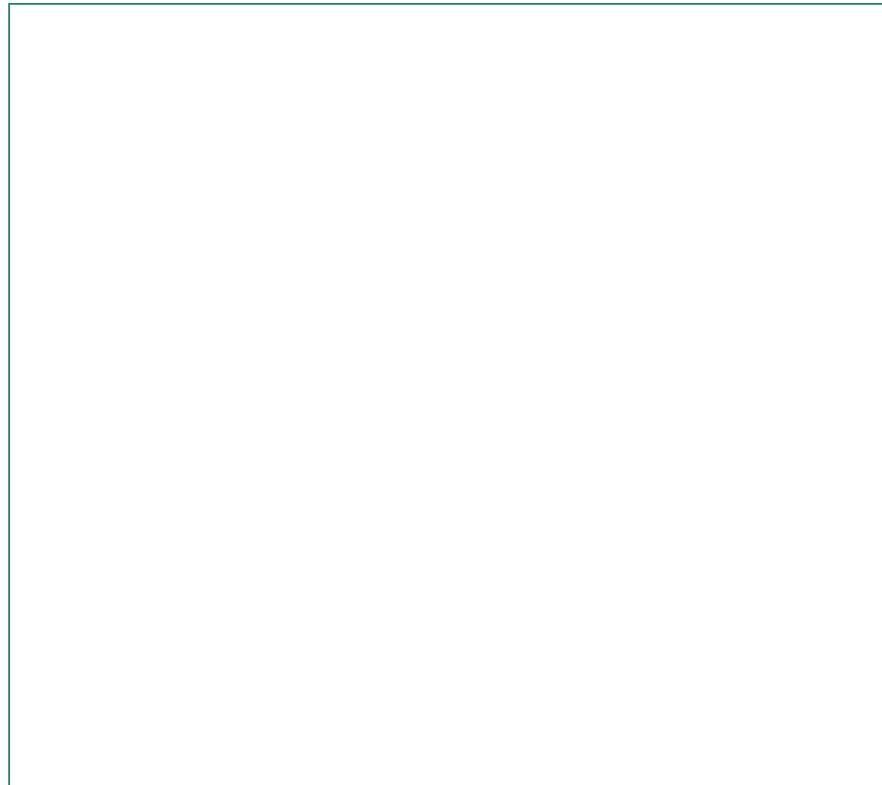
First Prototype

I discovered that _____

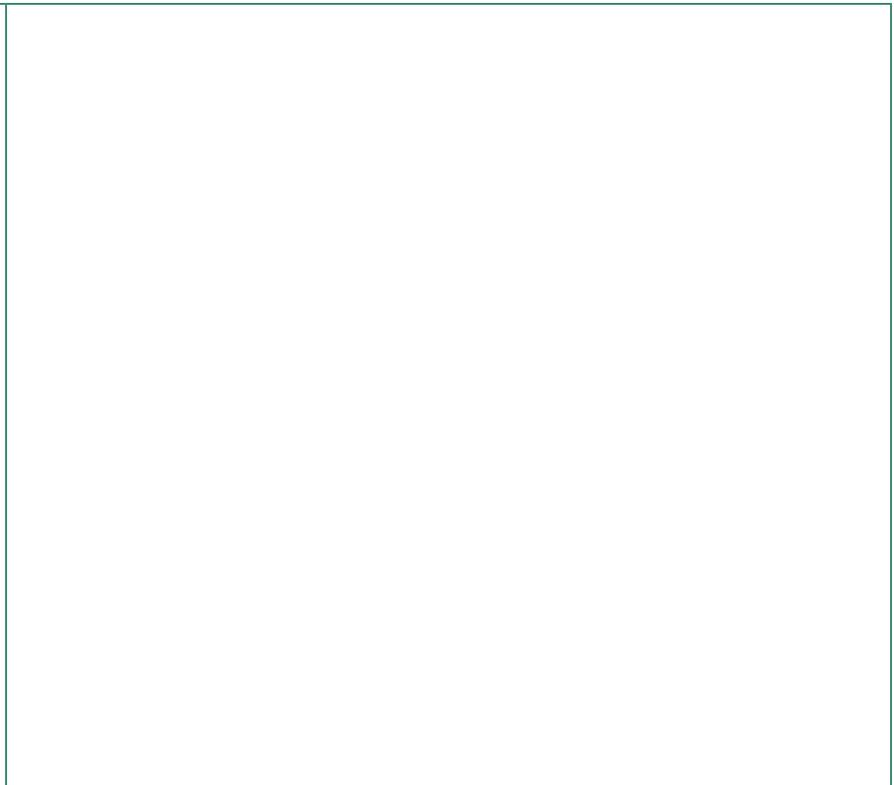
Try Again

Second Prototype

I discovered that _____



Draw and label model of first test.



Draw and label model of second test.

My Reflection

Just think! Before toilet paper, what did people use? Nothing? Dried leaves? Dried corn cobs? We take toilet paper for granted. In China, most places don't have toilet paper. American's traveling to China bring their own with them, or they stay in large progressive cities like Shanghai where they have "western bathrooms". (meaning toilets and not holes that people squat over) I know right!

Describe your favorite engineered invention. It could be a game, clothes, or a wheel.

How does this engineered invention help you, personally?

How would your life be different without it?

Exit Ticket

What do engineers do?

What kind of engineers are there?

Describe what kind of problems YOU can solve being an engineer.

The Big Idea: Engineers define problems and solve them. They fail forward, as they improve their solutions.

Student Objective(s):

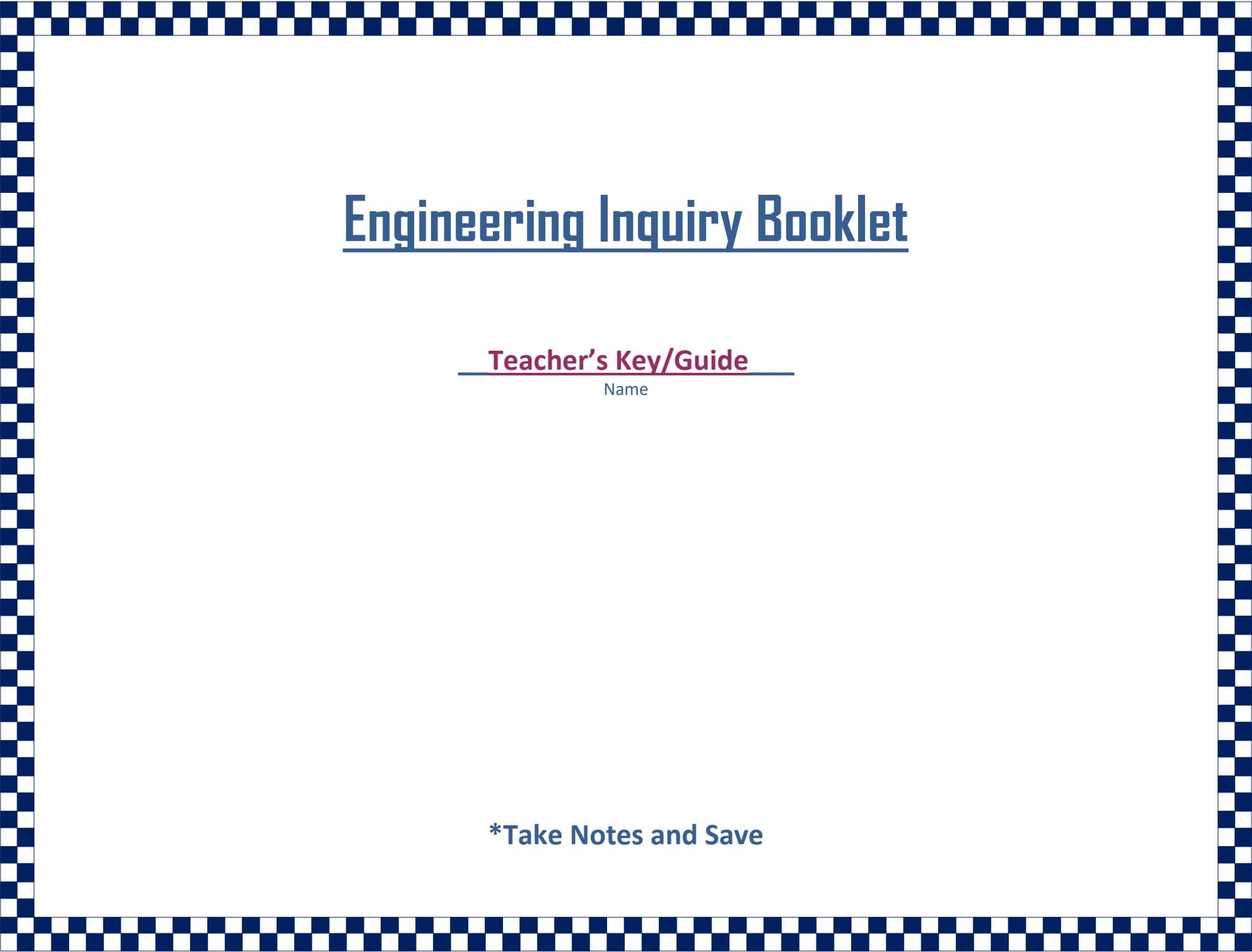
- 1) Students will investigate what an engineer does.**
- 2) Students will practice being engineers and solve a problem using an engineering design process.**

5.ETS1.1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

5.ETS1.2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

5.ETS1.3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Essential Question: What do engineers do? What kinds of engineers are there?
Can you be an engineer?



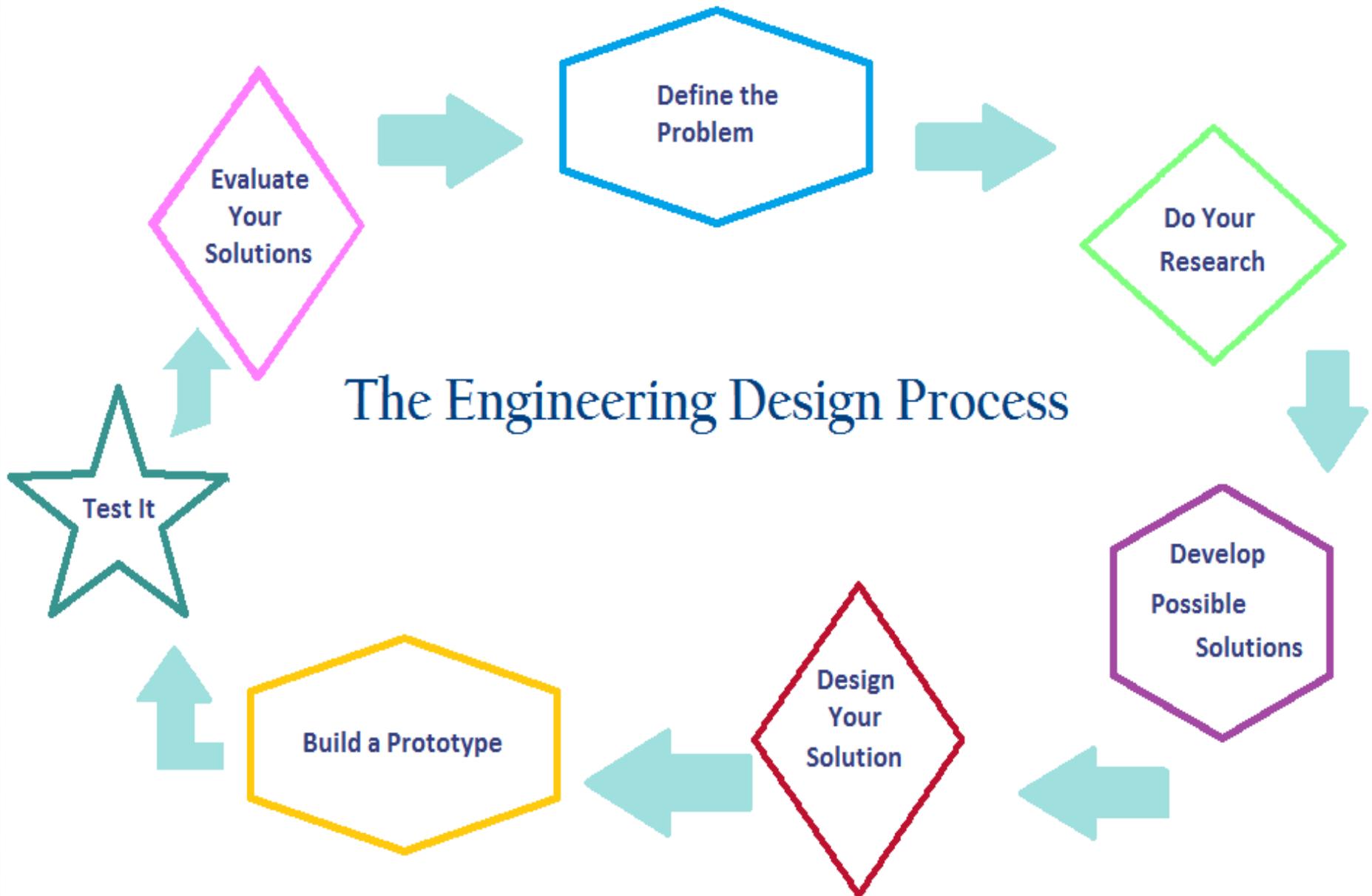
Engineering Inquiry Booklet

Teacher's Key/Guide

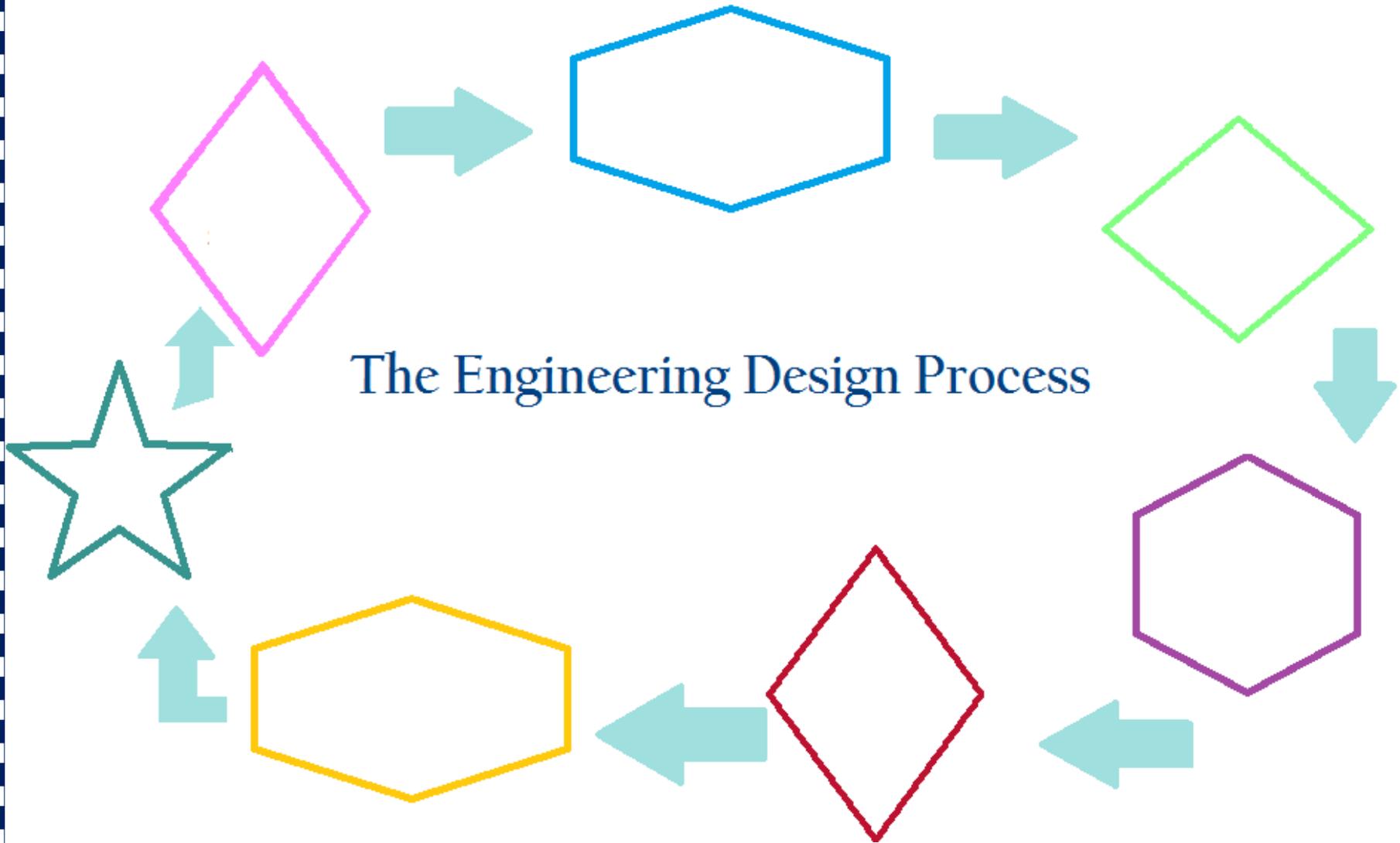
Name

***Take Notes and Save**

The Engineering Process



Create your Own Engineering Design Process
Use Words Meaningful to You



Key

This week we are going to learn what engineers are and practice what engineers do.
Take notes from the video. It goes fast, so be prepared to write fast. Stop at 9:28.

What is an engineer?

- * They are people who like to figure out how and why things work.
- * They like to solve problems.
- * They design and build things to solve a problem.

What are the three questions that engineers try to solve?

1. What is the problem that needs to be solved?
2. Who has the problem that needs to be solved?
3. Why is it important to solve this problem?

Key

Continue taking notes from the video. It goes fast, so be prepared to write fast. Stop at 9:28.

What did you notice about these items from the video.

The Golden Gate Bridge:

People had a problem. They needed a boat to get in and out of San Francisco. They solved their problem by engineering and designing the Golden Gate Bridge.

Henry Ford's Model T-Ford:

Henry Ford was a mechanical engineer. He's famous for engineer and designing more cost effective autos so that they could be affordable for everyone. It changed how people traveled. (from horses to cars)

Marissa Meyer:

She is a software engineer for Yahoo.

Alexander Graham Bell:

The problem was that communication was expensive and took a long time. The telephone solved that problem.

Alfred Nobel:

Coal miners needed an explosive. Nobel invented dynamite to help solve the problem.

Why didn't we need aerospace engineers in the 1800's?

We didn't have airplanes yet, so there were no problems to solve with airplanes yet. Many kinds of engineers don't exist yet.

What do you think engineers can't be afraid of in order to do their jobs?

Engineers can't be afraid to fail. They have to design and build many prototypes before they have success. This is called "failing forward".

Key

What are engineers and what do engineers do.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Start at 9:28. Stop at 20:26.

The first step is to **DEFINE A PROBLEM.** Write down kinds of problems.

How can I get across the gorge?

How does an engineer define a problem?

An engineer asks questions to define the problem. For example, in the video she asked if she could go across a bridge, swim across the water, or climb down and back up.

What are some problems that have been or can be solved by engineers?

Communication was solved with telephones.

Keeping food fresh was solved by refrigerators.

Seeing at night was solved by light bulbs.

What does a good solution have?

A good solution should have a criteria so that you know if your solution solved the problem effectively.

Key

Continue taking notes, your thoughts, and your ideas. Stop at 20:26.

What is **identifying the criteria**?

The criteria is how the engineer decides if the solution is successful. What would be a successful solution to the problem be? Criteria checklist can help engineer decide if their solution is successful.

Variables are conditions or values that can be changed. There are two kinds of variables.

Variables that **we can change** (list some examples)

- We can change how high we bounce a ball from.
- We can change the type of ball we bounce.
- We can reduce weight by taking away something.
- We can add weight by adding something.
- We can change the design.

Variables that **we cannot change** (list some examples)

- We can't change gravity.
- We can't change the wind.

Name as many "what ifs" that you can think of off the top of your head.

What if...

- the wind is blowing hard
- the wind isn't blowing at all
- the Cat in the Hat makes a mess of the investigation
- a dog runs away with the ball
- a tree is in the way of my investigation
- the sun doesn't come up that day and I can't see

Key

What are engineers and what do engineers do.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Start at 20:27. Finish watching the rest of the video.

Why do we identify variables?

Changing variables change the outcome, or result of the solution.

What are the two variables that can be changed in the “marshmallow game”?

1. The angle of the launch is a variable.
2. How far we pull back is another variable.

Why do we change only one variable at a time?

If we change one variable at a time, then we can determine which variable made a difference.

Key

It goes fast, so be prepared to write fast. Start at 20:27. Finish watching the rest of the video.

Define the Problem: The problem is to rescue the cell phone from the sewer.

Consider the solutions: 1) Rope to lower self into the sewer.

2) Use a fishing pole to fish out the cell phone.

3) Build a robot.

Design Solution: The robot needs to be able to fly, be remote controlled, have a camera, and have a suction cup.

Identify the Variables

Fixed Variables: sewer depth, phone size, phone weight

Variables: propellers, suction cup, camera

Challenge: Can you come up with your own solution? What would your robot look like?

My robot would look like this: (Design and draw a model of your robot and label the variables.)

**Designs will vary.
Students should label variables.**

Key

It goes fast, so be prepared to write fast. Start at 20:27. Finish watching the rest of the video.

Define the Problem: I need a secluded place so I can have privacy.

Consider the solutions: 1) Box

2) Change existing space like my room.

3) Architect a treehouse.

Design Solution: The treehouse needs to have a drop down rope ladder, window, blankets, and space.

Identify the Variables

Fixed Variables: size of the tree

Variables: weight of the treehouse, number and size of blankets, noise that I make for number of blankets.

Challenge: What would your treehouse look like? How would it meet success criteria and navigate the variables?

My treehouse would look like this: (Design and draw a model of your treehouse and label the variables.)

**Treehouse models will vary.
Students should label the variables.**

Key

Failing Forward! Prototype After Prototype After Prototype After....Prototype!

Discuss-Write notes or thoughts.

What do you think it means to “fail forward”? It is learning from our failures. Example: Riding a bike. We learn quickly how to ride, because we don't like to fall. But we don't give up. We keep trying.

Turn to a partner and talk about how you have “failed forward” and how it helped you.

Read together.

Scientists, engineers, architects, and other great problem solvers aren't afraid of failing forward. People who are afraid to fail forward become afraid to try things. The best inventions probably took thousands of prototypes or “back to the drawing boards”.

As successful scientists, engineers, and problem solvers, we will be brainstorming, designing models, building prototypes, and testing over and over again. Each time we test a prototype or talk to another person that did something different than us, we get brilliant ideas on how to improve our prototypes. It never ends. Apple keeps improving their iPhones. iPhone 6, iPhone 6S, and so on. Pixar and Google are cutting edge companies where their engineers or designers talk and brainstorm ideas and their ideas get better and better the more they collaborate, or work together. We, as consumers, benefit from the products that they keep putting out and the prototypes that they are constantly improving.

Establish that in our class, we will be encouraging each other, so that people aren't afraid to try.

How many failures did Audri think he would have? He thought that he would have 10-20 failures.

How many failures did Audri have? Audri had 4 failures.

Do you think Audri is afraid of failures? Why or Why not? No. Audri wasn't afraid of failing because he was prepared to keep redesigning his prototype over and over until he got it right.

Design and Test a Parachute

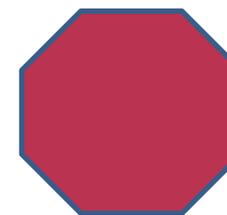
Let's try being engineers!

Student objective: We are going to learn about air resistance while we try using the "Engineer Design Process". We are going to design cool parachutes that can fall slowly to the ground. We will test it and make modifications to our prototypes and document our trials.

Supplies: A plastic bag or light material; Scissors; String; A small object to act as the weight, like a small action figure.

Steps:

1. Cut out a large square from your plastic bag or material.
2. Trim the edges so it looks like an octagon (an eight sided shape).
3. Cut a small whole near the edge of each side.
4. Attach 8 pieces of string of the same length to each of the holes.
5. Tie the pieces of string to the object you are using as a weight.
6. Use a chair or find a high spot to drop your parachute and test how well it worked, remember that you want it to drop as slow as possible.



Criteria

Parachute will descend slowly to the ground, giving your figure/weight a comfortable landing.

When you release the parachute, the weight will pull down on the strings and open up a large surface area of material that uses air resistance to slow it down.

Discoveries. The larger the surface area the more air resistance and the slower the parachute will drop. Cutting a small hole in the middle of the parachute will allow air to slowly pass through it rather than spilling out over one side, this should help the parachute fall straighter.

Key

Design and Test a Parachute Let's try being engineers!

Record Findings:

First Prototype

I discovered that The larger the surface area the more air resistance.

Cutting a small hole in the middle will allow air to slowly pass through it.

Try Again

Second Prototype

I discovered that _____

Ideas will vary. Encourage all ideas to let students discover at their own paces what works and doesn't work.

Discuss first prototype findings and give students time to do a 2nd prototype.

Ideas will vary. Encourage and praise all ideas to encourage students to not be afraid of "failing forward". This sets the climate of the classroom expectations for the school year.

Draw and label model of first test.

Draw and label model of second test.

Key Answers will vary. Expect answers to reflect understanding of purpose of engineers and their products.

My Reflection

Just think! Before toilet paper, what did people use? Nothing? Dried leaves? Dried corn cobs? We take toilet paper for granted. In China, most places don't have toilet paper. American's traveling to China bring their own with them, or they stay in large progressive cities like Shanghai where they have "western bathrooms". (meaning toilets and not holes that people squat over) I know right!

Describe your favorite engineered invention. It could be a game, clothes, or a wheel.

How does this engineered invention help you, personally?

How would your life be different without it?

Key: Answers will Vary
Expect applicative responses.

Exit Ticket

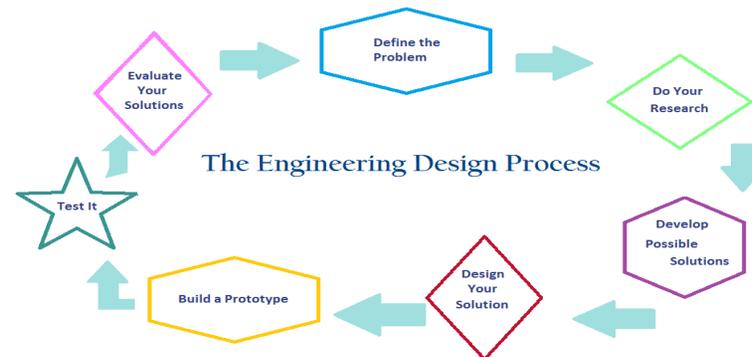
What do engineers do?

What kind of engineers are there?

Describe what kind of problems YOU can solve being an engineer.

Name Key

Engineering and Design Pre-test/Post Test



Matching questions: Read the term on the left and write the letter that best describes it.

<u>Term</u>	<u>Definition</u>
1. <u>c.</u> testing prototype	a. This is the step in the engineer design process where you need to identify your success criteria or checklist.
2. <u>e.</u> engineers	b. When someone learns from their mistakes and keeps trying.
3. <u>a.</u> design your solution	c. This is the step in the engineer design process where you determine if the prototype met the success criteria. This step will be repeated until there is success.
4. <u>b.</u> failing forward	d. This is the first step in the engineer design process.
5. <u>d.</u> define the problem	e. People who design and build things to solve problems.

Multiple choice questions: Read the description and shade in the bubble of the term that the description describes.

5. A condition or value that can be changed.

- variables
- criteria
- prototype
- engineers

6. This is the step in the engineer design process where you brainstorm ideas that could solve the problem.

- define the problem
- design your solution
- develop possible solutions
- variables

7. The design or model to be tested.

- engineers
- criteria
- variables
- prototype

8. The standards that help engineers measure how well their design does its job.

- engineers
- criteria
- prototype
- variables



Star Study

Name

**Take Notes and Save*

This week we are going to learn about stars.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. *Seeing Stars Crash Course 20.1*

What is a star?

What is the most famous star?

How many stars are there out there?

What three things are commonly mistaken for stars?

Why do planets appear brighter than stars?

How can we tell a planet from a star?

How can we tell an asteroid from a star?

Play "Star or Not a Star"? Circle your guess.

Object 1: Star Not a Star

Object 2: Star Not a Star

It's okay if you guessed wrong. Do you see why you missed it, if you did? (Hey! That's how we learn right? We try things.)

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Glow On Crash Course 20.2

How do stars glow?

How do some stars seem to glow brighter than other stars?

Describe how stars create energy?

What two gases are stars made up of?

How do astronomers determine stars brightness?

Can small stars be brighter than large stars?

- 1.
- 2.

Fill in the blanks..... Use Betelgeuse, Betelgeuse, sun, sun, and Earth.

_____ is brighter than the _____, but the _____ is closer to _____, so the sun appears brighter than _____.

Objects that are closer look bigger!



Is the little girl on her dad's shoulders really Almost as tall as the Magical Disney Castle?

Write thoughts or ideas.....

Is this class of 8th graders in front of the White House Really longer than the White House?

Write thoughts or ideas.....

Create Fairy Glow Jars

Supplies: Jars with a lids; glow in the dark paint (Tulip paint works well); paint brush; paper bags, paint tray, or something thing paint on; glue; glitter.

Steps:

1. Squirt glow in the dark glue on paper or paint tray.
2. Paint the bottom of jar first. Paint on in dots. (Note: Small dots close together look better than bigger dots further apart.)
3. Let the jars dry in the sun for 30 minutes or longer to activate the glow better.
4. Put a thin, even layer of glue on top of the lid and sprinkle it evenly with glitter. Tap off and save
5. the extra glitter.



Take notes from the video and write your own thoughts and ideas.

Video 1: Star Size and Comparison 2:48

What I noticed.....

What I wonder.....

Write any profound thoughts that you had watching the video.

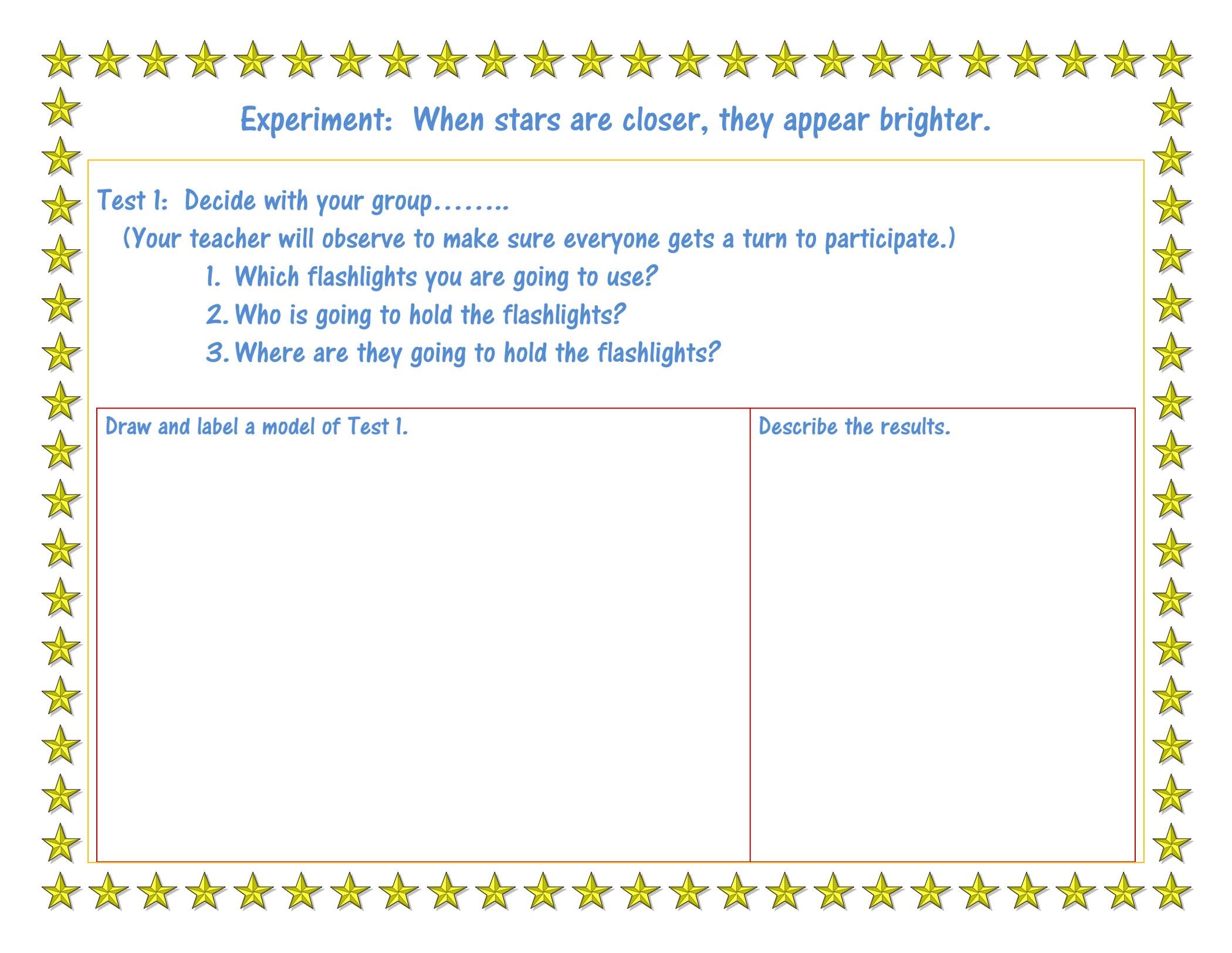
Video 2: Grade 5 Lesson 11: Apparent Brightness of Stars 44 seconds

Demonstrations

Demonstration 1: Why is the girl's flashlight brighter?

Demonstration 2: Why is his flashlight brighter?

Demonstration 3: Why did the bright get dimmer?



Experiment: When stars are closer, they appear brighter.

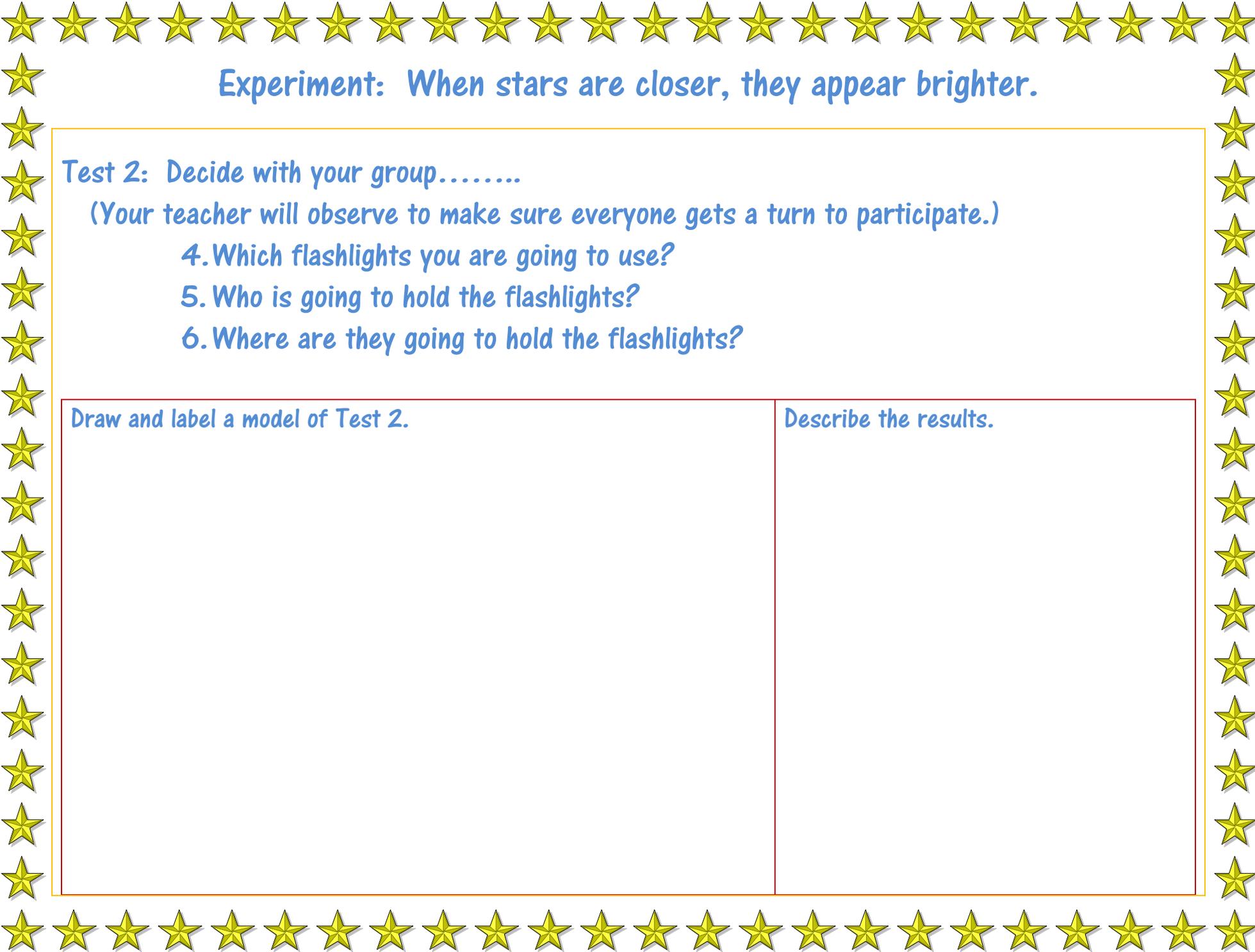
Test 1: Decide with your group.....

(Your teacher will observe to make sure everyone gets a turn to participate.)

1. Which flashlights you are going to use?
2. Who is going to hold the flashlights?
3. Where are they going to hold the flashlights?

Draw and label a model of Test 1.

Describe the results.



Experiment: When stars are closer, they appear brighter.

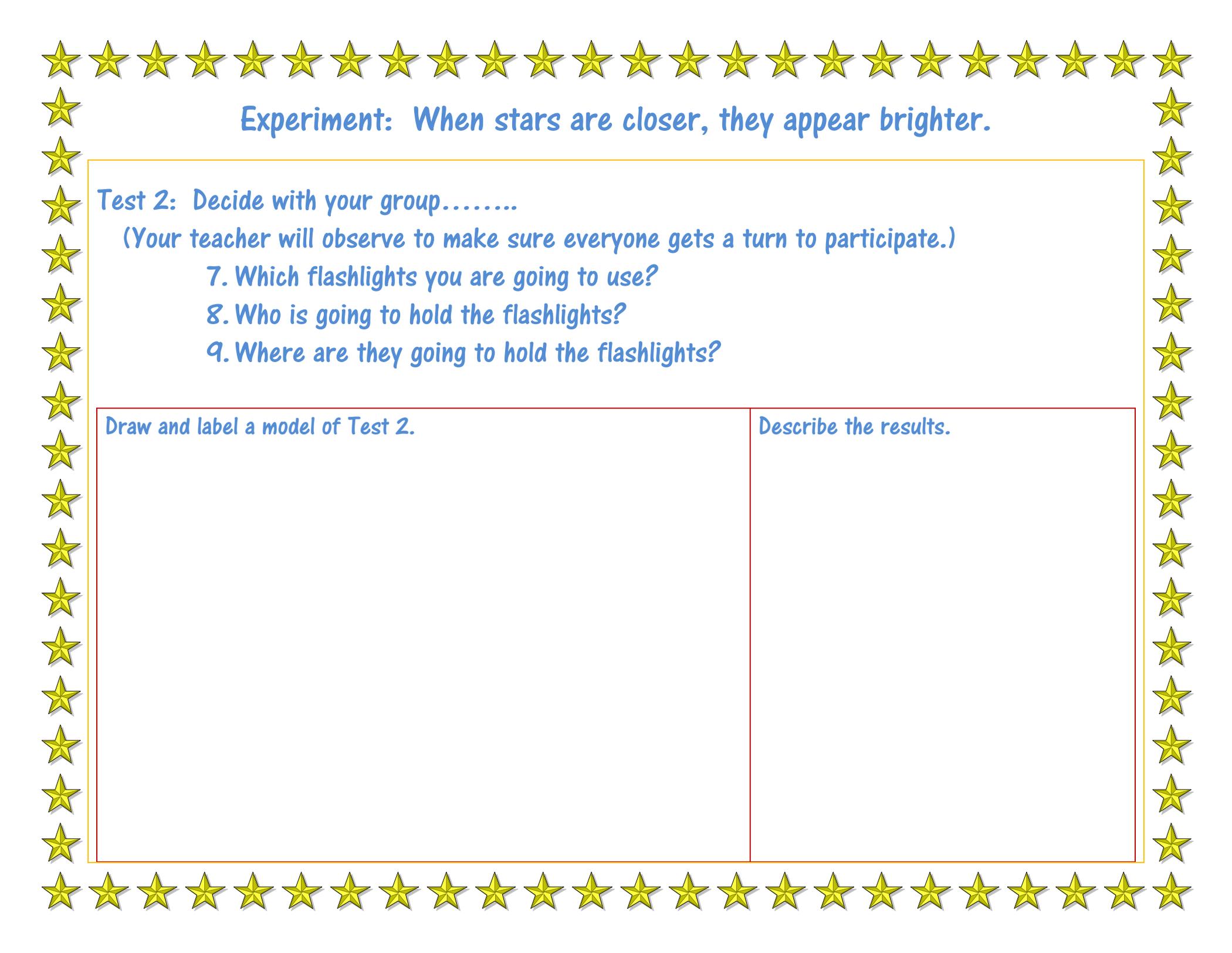
Test 2: Decide with your group.....

(Your teacher will observe to make sure everyone gets a turn to participate.)

- 4. Which flashlights you are going to use?**
- 5. Who is going to hold the flashlights?**
- 6. Where are they going to hold the flashlights?**

Draw and label a model of Test 2.

Describe the results.



Experiment: When stars are closer, they appear brighter.

Test 2: Decide with your group.....

(Your teacher will observe to make sure everyone gets a turn to participate.)

7. Which flashlights you are going to use?

8. Who is going to hold the flashlights?

9. Where are they going to hold the flashlights?

Draw and label a model of Test 2.

Describe the results.

Design a Create a Star Brightness Model

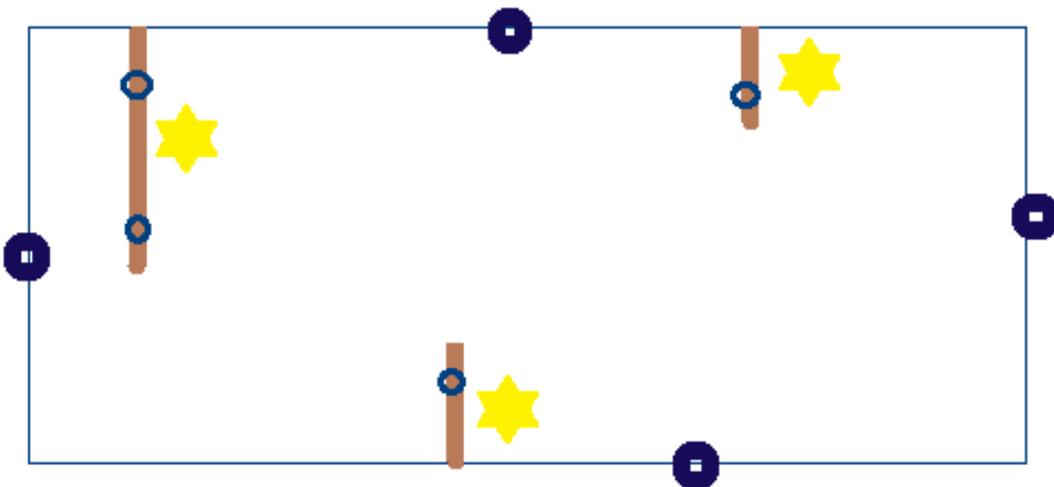
Your Objective: Design a model to demonstrate that stars closer appear brighter.

Supplies: Shoebox; cardboard; cardstock; glow in the dark paint; scissors; glue; and flashlight.

Steps:

1. Cut out 3 stars on cardstock. They must be the exact same size.
 2. Paint one side of each of the stars with glow in the dark paint.
 3. Cut, poke holes in, and glue stars onto the cardboard pieces.
 4. Glue cardboard pieces into the shoebox.
 5. Poke holes throughout the shoebox to test which will give the stars the best lighting.
 6. Cover the shoebox.
 7. Shine light through the holes to determine which gives the model the best lighting.
 8. Your model should demonstrate that the closest star appears brighter than stars further away.
- Use the diagram to help give you ideas to you plan your model.

Star Shoebox Model



Key
Cardboard 
Stars 
Holes-wherever you want 

Feedback Form for the Presenter

My Model: Stars Appear Brighter if they are Closer

Presenter's Name _____

Your Name _____

Help your Partner!

Good speaking skills!

Circle 1-3

- Looks at audience/Talks to the audience (not floor)
- Addresses important questions about the project.
- Loud enough to be heard & speaks clearly.
- Doesn't say "um" or "uh".
- Doesn't fidget.

1	2	3
1	2	3
1	2	3
1	2	3
1	2	3

About the model!

- The model demonstrates that stars closer appear brighter.
- The presenter explained and I understood how the model works.

1	2	3
1	2	3

Bonus listening skill points. Listens to others presenting.

1 2 3

Total Grade

_____/21

Presentation Rubric

My Model: Stars Appear Brighter if they are Closer

Presenter's Name _____

Good speaking skills!

Circle 1-3

- Looks at audience/Talks to the audience (not floor)
- Addresses important questions about the project.
- Loud enough to be heard & speaks clearly.
- Doesn't say "um" or "uh".
- Doesn't fidget.

1	2	3
1	2	3
1	2	3
1	2	3
1	2	3

About the model!

- The model demonstrates that stars closer appear brighter.
- The presenter explained and I understood how the model works.

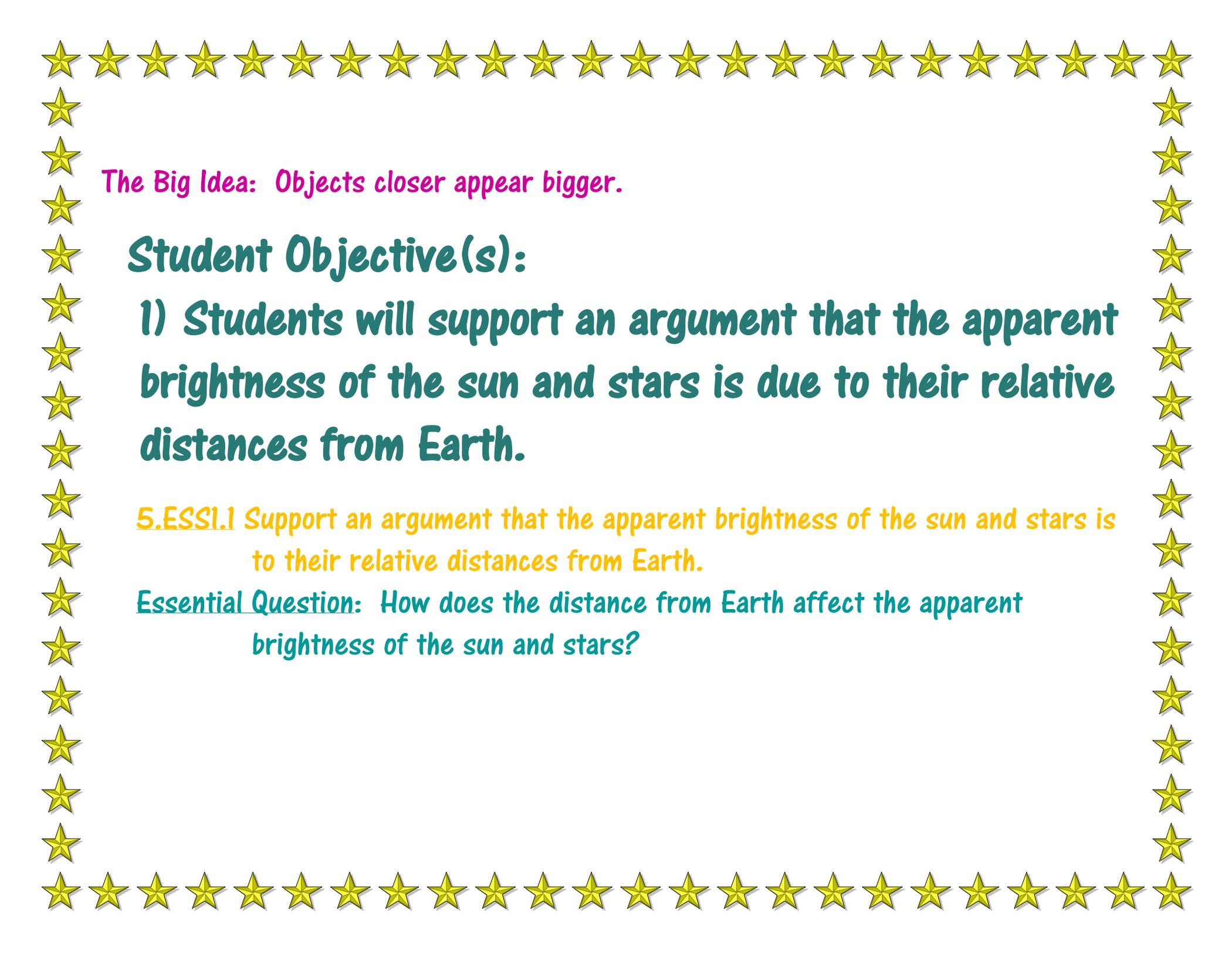
1	2	3
1	2	3

Bonus listening skill points. Listens to others presenting.

1	2	3
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Total
Grade

_____/21



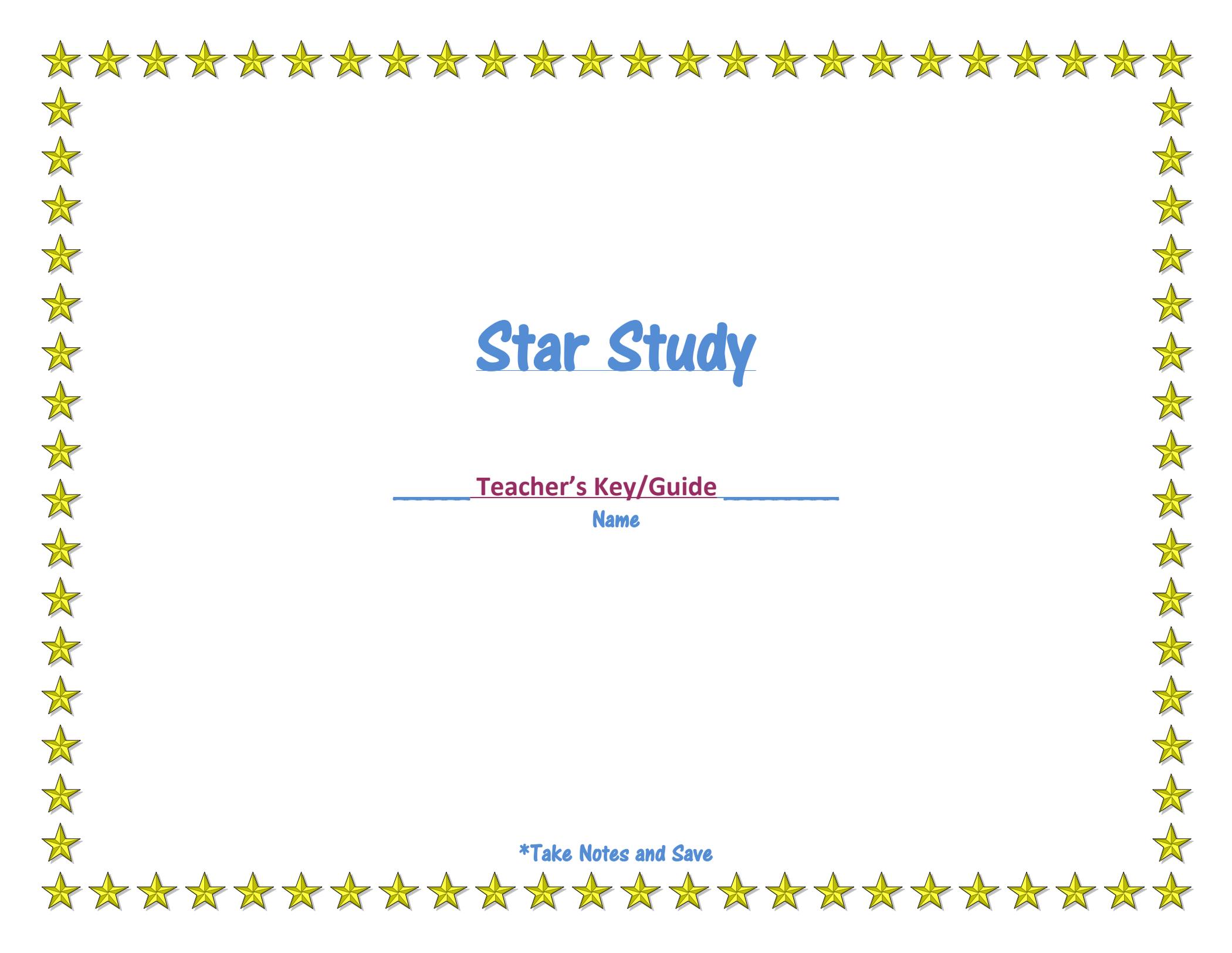
The Big Idea: Objects closer appear bigger.

Student Objective(s):

1) Students will support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.

5.ESS1.1 Support an argument that the apparent brightness of the sun and stars is to their relative distances from Earth.

Essential Question: How does the distance from Earth affect the apparent brightness of the sun and stars?



Star Study

Teacher's Key/Guide

Name

**Take Notes and Save*

Key

This week we are going to learn about stars.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. *Seeing Stars Crash Course 20.1*

What is a star?

A bright object that gives off light by energy produced in its core.

How many stars are there out there?

There are billions of stars.

Why do planets appear brighter than stars?

Planets are closer than stars are to us.

How can we tell an asteroid from a star?

Asteroids move and don't twinkle.

What is the most famous star?

The sun is the most famous star.

What three things are commonly mistaken for stars?

1. planets
2. dwarf planets
3. asteroids

How can we tell a planet from a star?

Planets change their position.

Play "Star or Not a Star"? Circle your guess.

Object 1: Star

Not a Star

Object 2: Star

Not a Star

It's okay if you guessed wrong. Do you see why you missed it, if you did? (Hey! That's how we learn right? We try things.)

★ Key

★ Take notes from the video and write your own thoughts and ideas.

★ It goes fast, so be prepared to write fast. Glow On Crash Course 20.2

★ How do stars glow?

★ The nuclear fusion created in the core travels out to the surface creating light and heat that make stars glow.

★ Describe how stars create energy?

★ Stars create energy through nuclear fusion.

★ How do astronomers determine stars' brightness?

- ★ 1. true brightness (luminosity)
- ★ 2. apparent brightness

★ Fill in the blanks..... Use Betelgeuse, Betelgeuse, sun, sun, and Earth.

★ Betelgeuse is brighter than the sun, but the sun is closer to Earth, so the sun appears brighter than Betelgeuse.

★ How do some stars seem to glow brighter than other stars?

★ When stars are a closer distance, they appear to glow brighter than other stars.

★ What two gases are stars made up of?

★ Stars are made up of hydrogen and helium.

★ Can small stars be brighter than large stars?

★ Yes. Small stars can be brighter, just like smaller light bulbs can be brighter than larger light bulbs.

Objects that are closer look bigger!



*Is the little girl on her dad's shoulders really
Almost as tall as the Magical Disney Castle?*

Write thoughts or ideas.....

Will vary.

If time, you can have students measure in cm. and make comparisons.

*Is this class of 8th graders in front of the White House
Really longer than the White House?*

Write thoughts or ideas.....

Will vary.

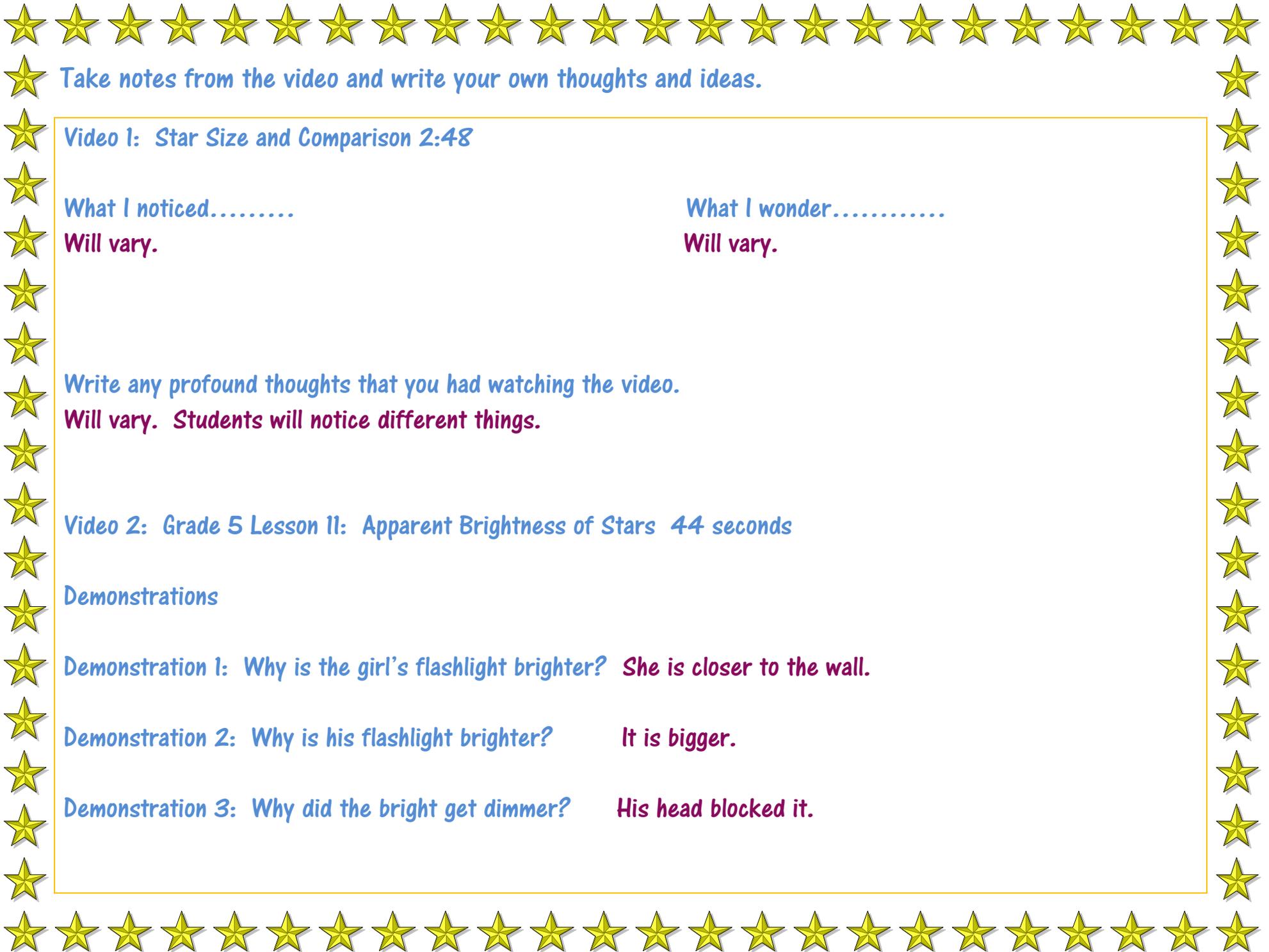
Create Fairy Glow Jars

Supplies: Jar with a lid; glow in the dark paint (Tulip paint works well); paint brush; paper bags, paint tray, or something thing paint on; glue; glitter.

Steps:

1. Squirt glow in the dark glue on paper or paint tray.
2. Paint the bottom of jar first. Paint on in dots. (Note: Small dots close together look better than bigger dots further apart.)
3. Let the jars dry in the sun for 30 minutes or longer to activate the glow better.
4. Put a thin, even layer of glue on top of the lid and sprinkle it evenly with glitter. Tap off and save
5. the extra glitter.





Take notes from the video and write your own thoughts and ideas.

Video 1: Star Size and Comparison 2:48

What I noticed.....

Will vary.

What I wonder.....

Will vary.

Write any profound thoughts that you had watching the video.

Will vary. Students will notice different things.

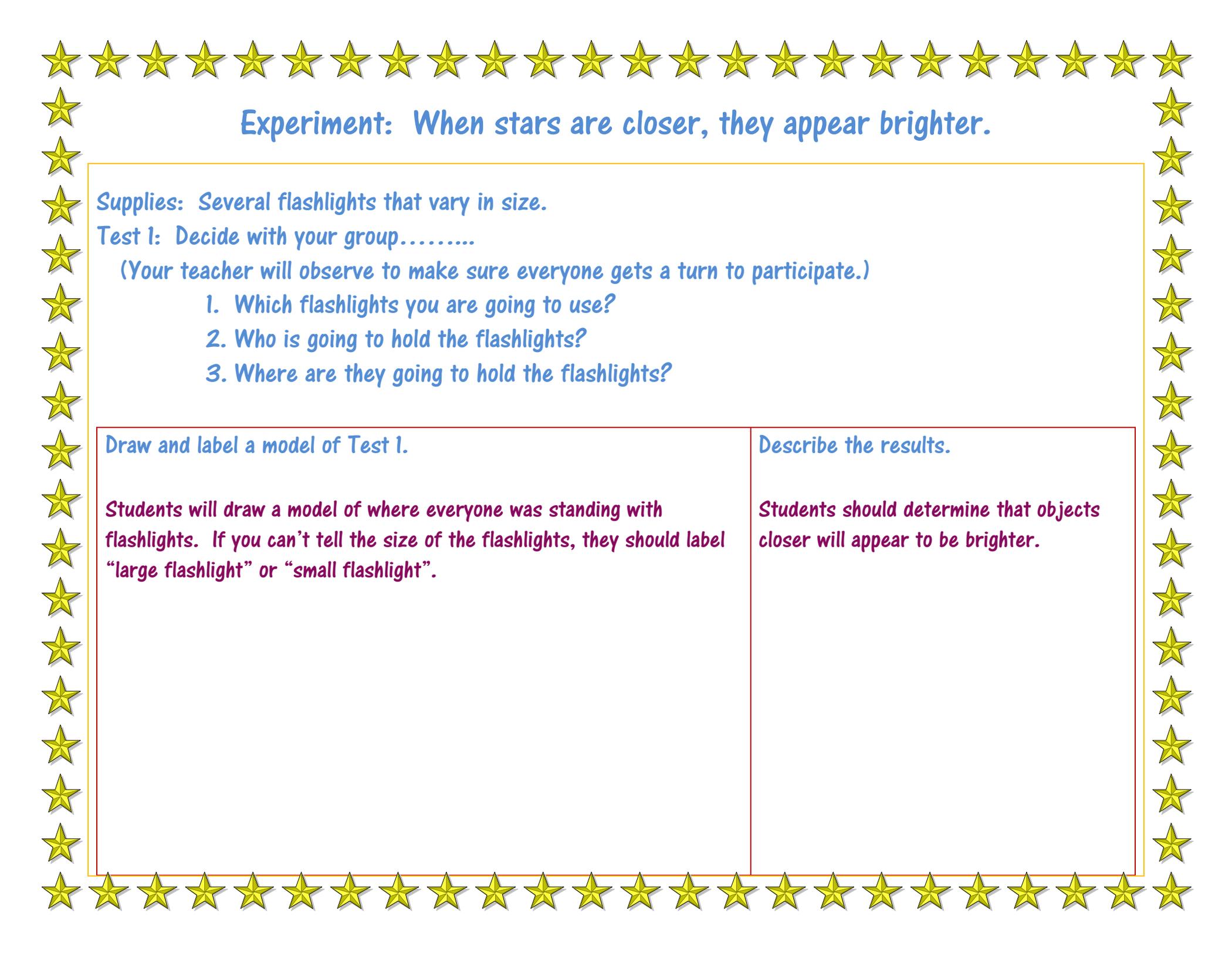
Video 2: Grade 5 Lesson 11: Apparent Brightness of Stars 44 seconds

Demonstrations

Demonstration 1: Why is the girl's flashlight brighter? She is closer to the wall.

Demonstration 2: Why is his flashlight brighter? It is bigger.

Demonstration 3: Why did the bright get dimmer? His head blocked it.



Experiment: When stars are closer, they appear brighter.

Supplies: Several flashlights that vary in size.

Test 1: Decide with your group.....

(Your teacher will observe to make sure everyone gets a turn to participate.)

1. Which flashlights you are going to use?
2. Who is going to hold the flashlights?
3. Where are they going to hold the flashlights?

Draw and label a model of Test 1.

Students will draw a model of where everyone was standing with flashlights. If you can't tell the size of the flashlights, they should label "large flashlight" or "small flashlight".

Describe the results.

Students should determine that objects closer will appear to be brighter.



Experiment: When stars are closer, they appear brighter.

Supplies: Several flashlights that vary in size.

Test 2: Decide with your group.....

(Your teacher will observe to make sure everyone gets a turn to participate.)

1. Which flashlights you are going to use?
2. Who is going to hold the flashlights?
3. Where are they going to hold the flashlights?

Draw and label a model of Test 2.

Students will draw a model of where everyone was standing with flashlights. If you can't tell the size of the flashlights, they should label "large flashlight" or "small flashlight".

Describe the results.

Students should determine that objects closer will appear to be brighter.

Experiment: When stars are closer, they appear brighter.

Supplies: Several flashlights that vary in size.

Test 3: Decide with your group.....

(Your teacher will observe to make sure everyone gets a turn to participate.)

1. Which flashlights you are going to use?
2. Who is going to hold the flashlights?
3. Where are they going to hold the flashlights?

Draw and label a model of Test 3.

Students will draw a model of where everyone was standing with flashlights. If you can't tell the size of the flashlights, they should label "large flashlight" or "small flashlight".

Describe the results.

Students should determine that objects closer will appear to be brighter.

Design a Create a Star Brightness Model

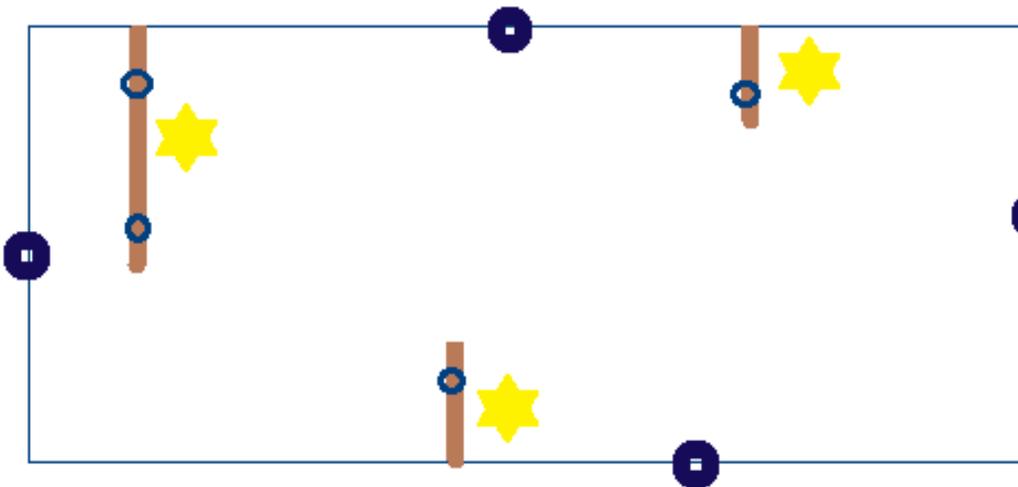
Your Objective: Design a model to demonstrate that stars closer appear brighter.

Supplies: Shoebox; cardboard; cardstock; glow in the dark paint; scissors; glue; and flashlight.

Steps:

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Star Shoebox Model



Key
Cardboard
Stars
Holes-wherever you want

Feedback Form for the Presenter

My Model: Stars Appear Brighter if they are Closer

Presenter's Name _____

Your Name _____

Help your Partner!

Good speaking skills!

Circle 1-3

- Looks at audience/Talks to the audience (not floor)
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- Loud enough to be heard & speaks clearly.
- Doesn't say "um" or "uh".
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1	2	3
1	2	3
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About the model!

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Bonus listening skill points. Listens to others presenting.

1 2 3

Total Grade

_____/21

Presentation Rubric

My Model: Stars Appear Brighter if they are Closer

Presenter's Name _____

Good speaking skills!

Circle 1-3

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Bonus listening skill points. Listens to others presenting.

1 2 3

Total Grade

_____/21

Name _____

Seasons from the Tilted Axis Pre-test/Post Test

Matching questions: Read the term on the left and write the letter that best describes it.

<u>Term</u>	<u>Definition</u>
1. _____ indirect sunlight	a) This is how long something is.
2. _____ shadows	b) The imaginary line which goes through the north and south poles and around which Earth spins. It is inclined and tilted 23.5 degrees from a vertical 90 degrees.
3. _____ Earth's revolution	c) The Earth spins around, or rotates, one full turn each day.
4. _____ length	d) Sunlight that is not fully facing Earth.
5. _____ seasons	e) Because the axis of the Earth is tilted, different parts of the world get different amounts of sun and heat causing winter, spring, summer and fall.
6. _____ Earth's rotation	f) The Earth makes a circle, or revolves, around the sun.
7. _____ Earth's axis	g) A figure or a shape made by an object blocking rays of light. The length and the direction depend on where the sun is located

Multiple choice questions: Read the description and shade in the bubble of the term that the description describes.

5. Half of the Earth above the equator.

- direct sunlight
- Earth's axis
- pattern
- northern hemisphere

6. A tool that uses the movement of the sun to keep track of time. The shadow cast from the sun tells the time.

- shadows
- sundial
- length
- seasons

7. This is when something happens repeatedly.

- seasons
- pattern
- shadows
- length

8. Sunlight that is straight on Earth.

- sundial
- direction
- direct sunlight
- indirect sunlight

9. This is which way something is goes.

- direction
- sundial
- pattern
- seasons

10. This is how long it takes for the Earth to revolve around the sun.

- 365 days
- sundial
- shadows
- seasons



Seasons from the Tilted Axis

Name

**Take Notes and Save*

This week we are going to learn about what makes a season.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Seeing Stars Crash Course 20.1

Where does the sun go when we can't see it?

What gives us day and night?

Describe Earth's rotation.

Describe Earth's revolution?

How many days does Earth's revolution take?

Does the Earth revolve while standing straight up and down?

Because the axis of the Earth is tilted, different parts of the world get different amounts of sun and heat. This causes the Earth to have _____. If the Earth wasn't tilted, then the world would be one temperature all the time.

Take notes from the video and write your own thoughts and ideas.
It goes fast, so be prepared to write fast. Seasons and the Sun Course 11.1

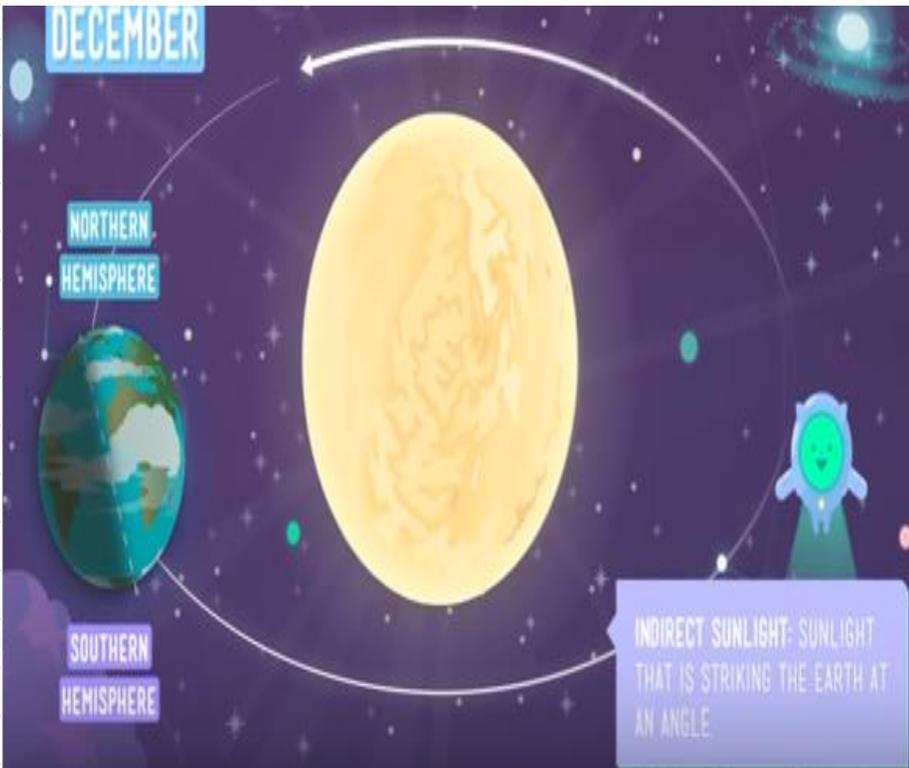
Summer



Circle: Direct Sunlight Indirect Sunlight

Describe how this demonstrates the summer sun.

Winter



Circle: Direct Sunlight

Indirect Sunlight

Describe how this demonstrates the winter sun.

The Seasons



Talk to your partner about how the axis tilt gives the northern hemisphere direct sunlight, indirect sunlight, and some direct sunlight. Discuss each globe.

Temperatures Over All the Seasons

AVERAGE HIGH TEMPERATURE

TORONTO, CANADA



Write down the temperatures for the average of each month and discuss with a partner how the sun and the seasons are linked.

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Reconstructing Earth Rotation, Revolution, and the Seasons

Activity

Supply: String or yarn, 4 pieces of masking tape, sun sign, and Earth sign

Need Groups of 4

Leader= Reads the directions

Sun- Stands in the middle

Earth- Goes around the sun.

Monitor- Watches to make sure the Earth is following directions.

Steps:

1. Select each person's role.
2. Have the sun stand in the middle with the sun sign.
3. The rest of the group will use the string/yarn to mark a large circle around the sun. Hold the string/yarn down with masking tape in quarters.
4. Decide which piece of tape represents each of the seasons.
5. Leader reads the directions.

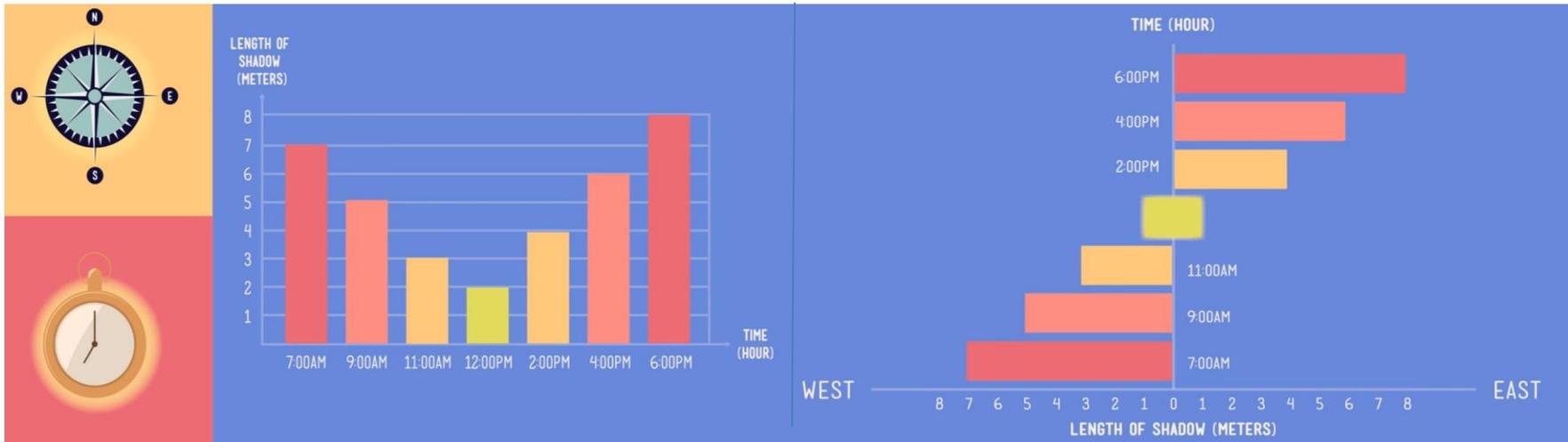
Directions:

- a) The Earth rotates. (Monitor makes sure Earth rotates.)
- b) The Earth rotates and is tilted. (Monitor makes sure Earth stays tilted)
- c) The Earth rotates, is tilted, and revolves around the sun. (Monitor makes sure Earth rotates, tilts, and revolves around the sun.)
- d) The Earth rotates, is tilted, revolves around the sun and calls out "Hot!" for summer, "Nice" for fall, "Brrr!" for winter, and "Ahhh!" for spring.

Trade roles. Each person in the group will try each role.

Take notes from the video and write your own thoughts and ideas.
It goes fast, so be prepared to write fast. Following the Sun CC 8.2

Describe how ancient Egyptians were able to tell time by watching the sun.



How does an object change from the sun?

What patterns can we discover from charting the length and direction of a shadow from morning to evening?

What is a shadow?

Activity

Objective: Students will gather data on shadow changes.

Choose a method. Measure student shadows or Measure an object.

Supplies:

- chalk and meter/yard stick and ruler, piece of duct tape, compass (download free compass apps on cell), data sheet.

Steps:

1. Students need a partner to help draw the chalk outlines.
2. Find sunny spot outside with direct sunlight.
3. Mark the spot with duct tape where you will stand each time for this experiment.
4. Partner will trace shadow. Measure and write in chalk the measurement.
5. Log each measurement on data sheet. Write unit. (m, ft, yd, etc.)
6. Switch and repeat for partner.
7. When finished, take data to classroom to determine patterns.

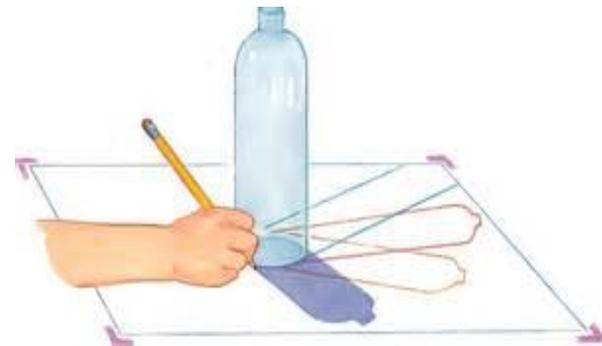


Supplies:

- an object (like a water bottle) to create shadows, butcher paper, duct tape, pencil, ruler/meter stick/yard stick, compass (download free compass apps on cell), data sheet.

Steps:

1. Find sunny spot outside with direct sunlight.
2. Tape paper down in direct sunlight. Write your name on your paper.
3. Trace shadow of the object selected. Measure and write the measurement by each trace.
4. Log each measurement on data sheet. Write unit. (in, cm, ft, etc.)
5. When finished, take data to classroom to determine patterns.





Shadow Measurements

Collect Data



What did you measure: _____

Graph 1

Graph 2

Times	Length (give units)	Direction (east or west)
9 a.m. or _____		
10 a.m. or _____		
11 a.m. or _____		
12 p.m. or _____		
1 p.m. or _____		
2 p.m. or _____		

What patterns did you notice?

Shadow Measurements Graphing

Graph 1-These are examples to guide step-by-step. Use your data values from yesterday.

Daily Changes in Length of Shadows

Go to Rapid Tables at <http://www.rapidtables.com/tools/bar-graph.htm>

1. Fill in the form.

2. Graph Title: **Shadow Lengths**

3. Horizontal Axis Label: **Times (9 a.m.; 10 a.m.; 11 a.m.; 12 p.m.; 1 p.m.; 2 p.m.)**

4. Vertical Axis Label: **Lengths (write the unit that you used to measure)**

5. Data Range: **This will be your smallest length to your greatest length.**

6. Number of Bars **6**

7. Bar 1 Data Value: Write the **1st** length.

Bar 1: **First time (ie 9 a.m.)**

8. Bar 2 Data Value: Write the **2nd** length.

Bar 2: **Second time (ie 10 a.m.)**

9. Bar 3 Data Value: Write the **3rd** length.

Bar 3: **Third time (ie 11 a.m.)**

10. Bar 4 Data Value: Write the **4th** length.

Bar 4: **Fourth time (ie 12 p.m.)**

11. Bar 5 Data Value: Write the **5th** length.

Bar 5: **Fifth time (ie 1 p.m.)**

12. Bar 6 Data Value: Write the **6th** length.

Bar 6: **Sixth time (ie 2 p.m.)**

13. Click the bar graph picture to complete the graph.

14. Print or use graph paper to create your own from the graph. For this you will need graph paper and colored pencils.

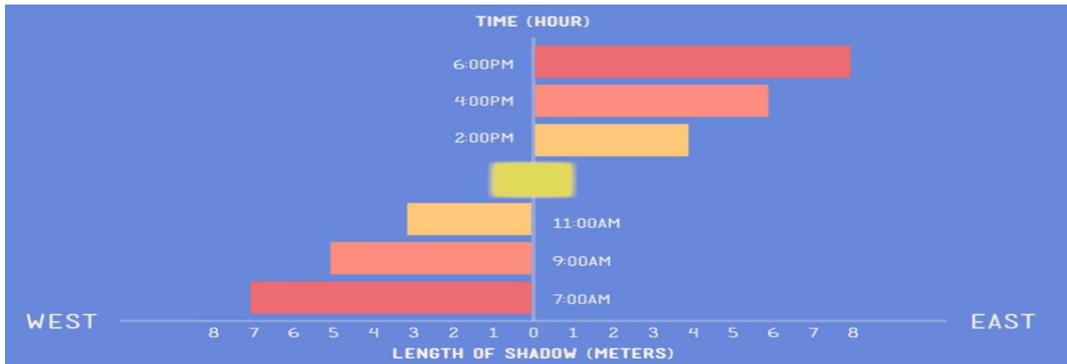
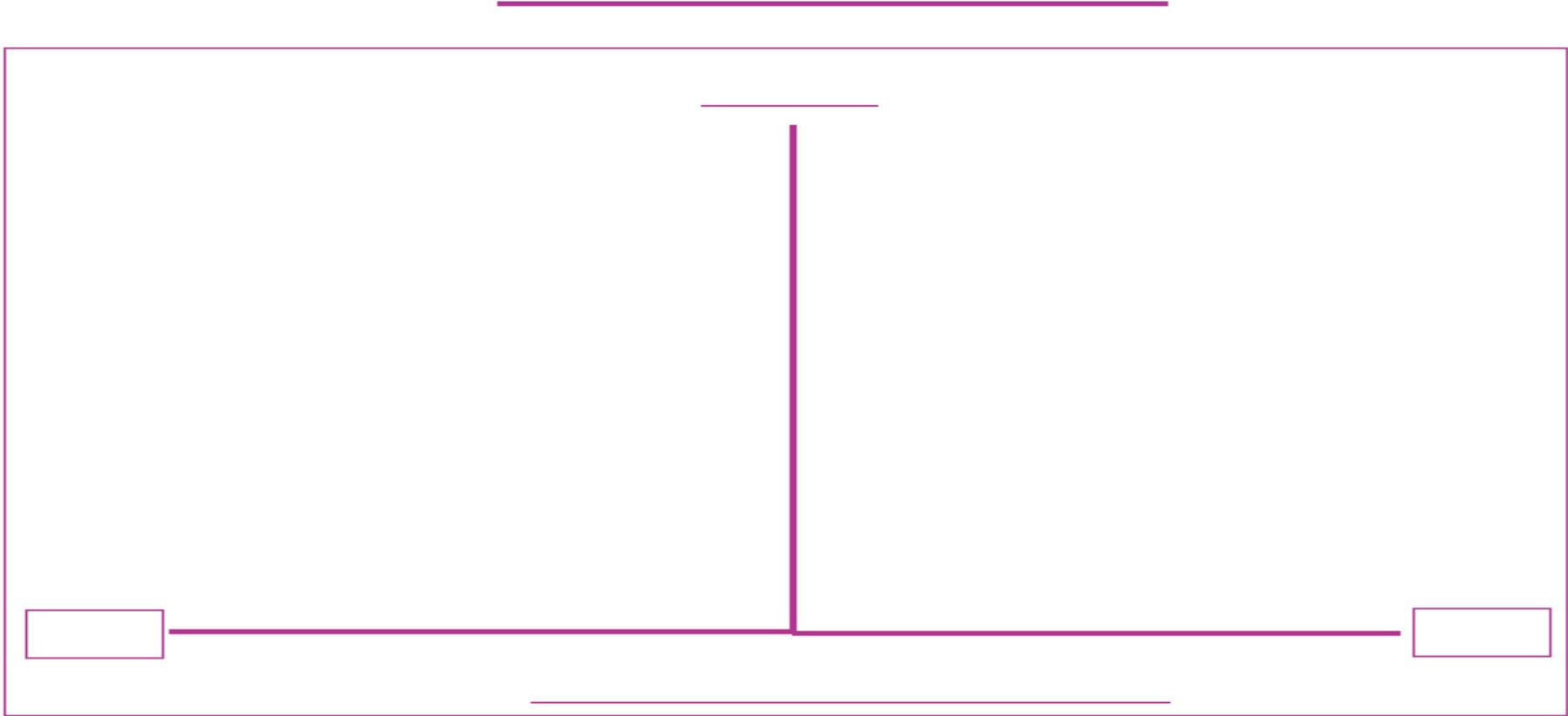
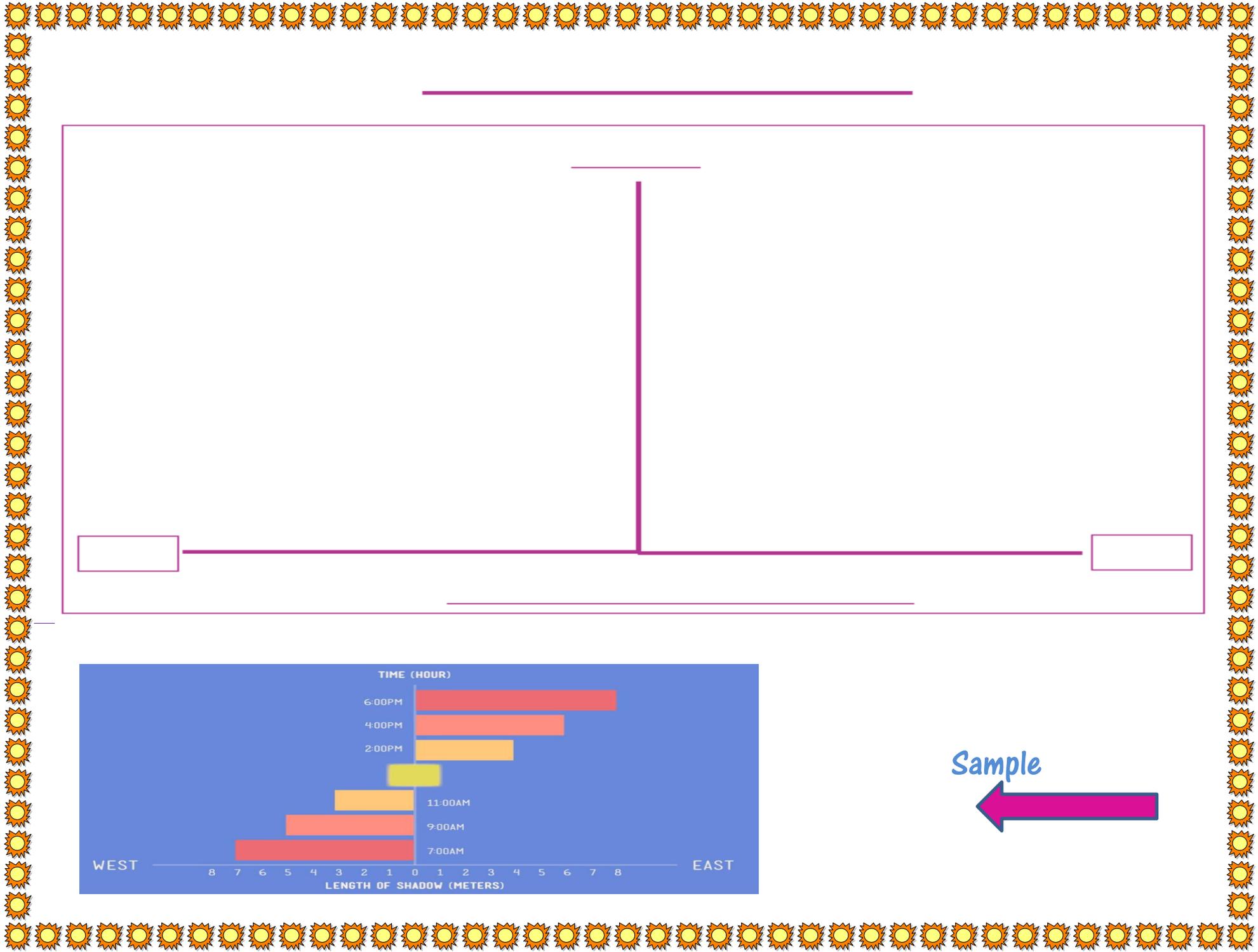
Shadow Measurements Graphing

Graph 2: Use your data values from yesterday.

Daily Changes in Direction of Shadows

Use the template to complete the following.

1. Fill in the title on the top line
2. Vertical axis: On the next line at the top of the graph, label “time”.
3. In the box on the left, write “West”.
4. In the box on the right, write “East”.
5. Horizontal Axis: On the line along the bottom of the graph, label “Length of Shadows in _____” (include units)
6. Label and fill in the graph using your data collected from yesterday. Include:
 - a) Times along the vertical axis
 - b) Lengths along the horizontal axis.
 - c) Draw and color in the bars. (Use straightedge or ruler)



Sample ←

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Constellation Location Crash Course 31.2

Are all of the constellations always visible from the sky, from everywhere on Earth?

The constellations that are visible to you depends on two things.

1. Where you are located, the _____ hemisphere or the _____ hemisphere
2. Which time of the year, or _____ that you are looking at the sky.

Describe how constellations appear to move across the night sky.

The change in stars position during the night, and over the year is actually a result of the Earth's

_____.

Different _____ appear to move into view in the night sky.

The Big Question!

Explore the constellation sites and review the data below to answer the big question at the bottom.

Talk to your partner about the Zodiac Constellations Data 2015 data below.

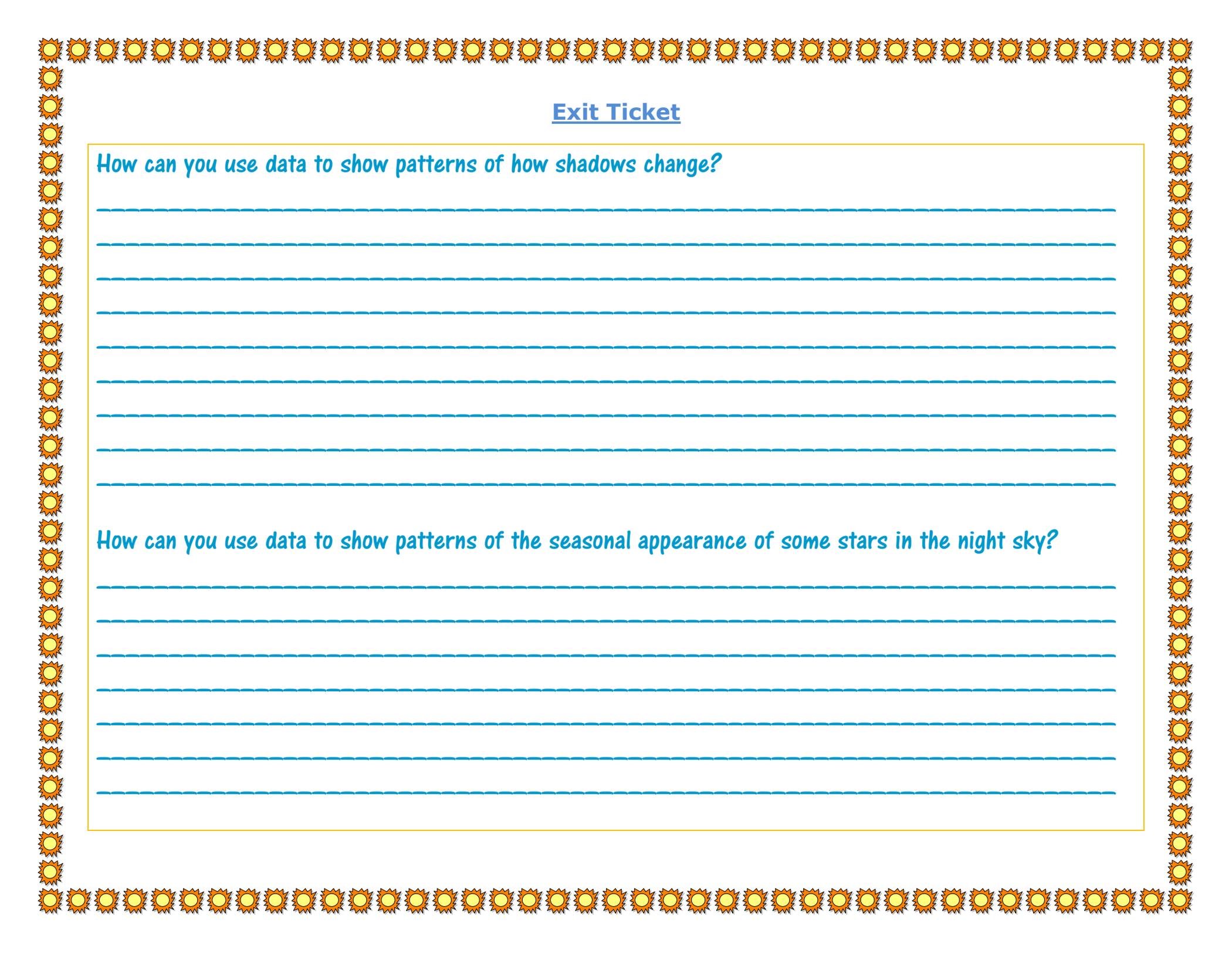
What patterns would you be able to determine if you continued to gather data over 10 years?

Zodiac Constellations Data 2015

Jan 20, 2015: constellation Capricornus (299.66°)	Aug 11, 2015: constellation Leo (138.13°)
Feb 16, 2015: constellation Aquarius (327.83°)	Sep 17, 2015: constellation Virgo (174.10°)
Mar 12, 2015: constellation Pisces (351.52°)	Oct 31, 2015: constellation Libra (217.75°)
Apr 19, 2015: constellation Aries (29.03°)	Nov 23, 2015: constellation Scorpius (241.08°)
May 14, 2015: constellation Taurus (53.41°)	Nov 30, 2015: constellation Ophiuchus (247.98°)
Jun 22, 2015: constellation Gemini (90.37°)	Dec 18, 2015: constellation Sagittarius (266.55°)
Jul 21, 2015: constellation Cancer (118.20°)	

Answer the BIG QUESTION.

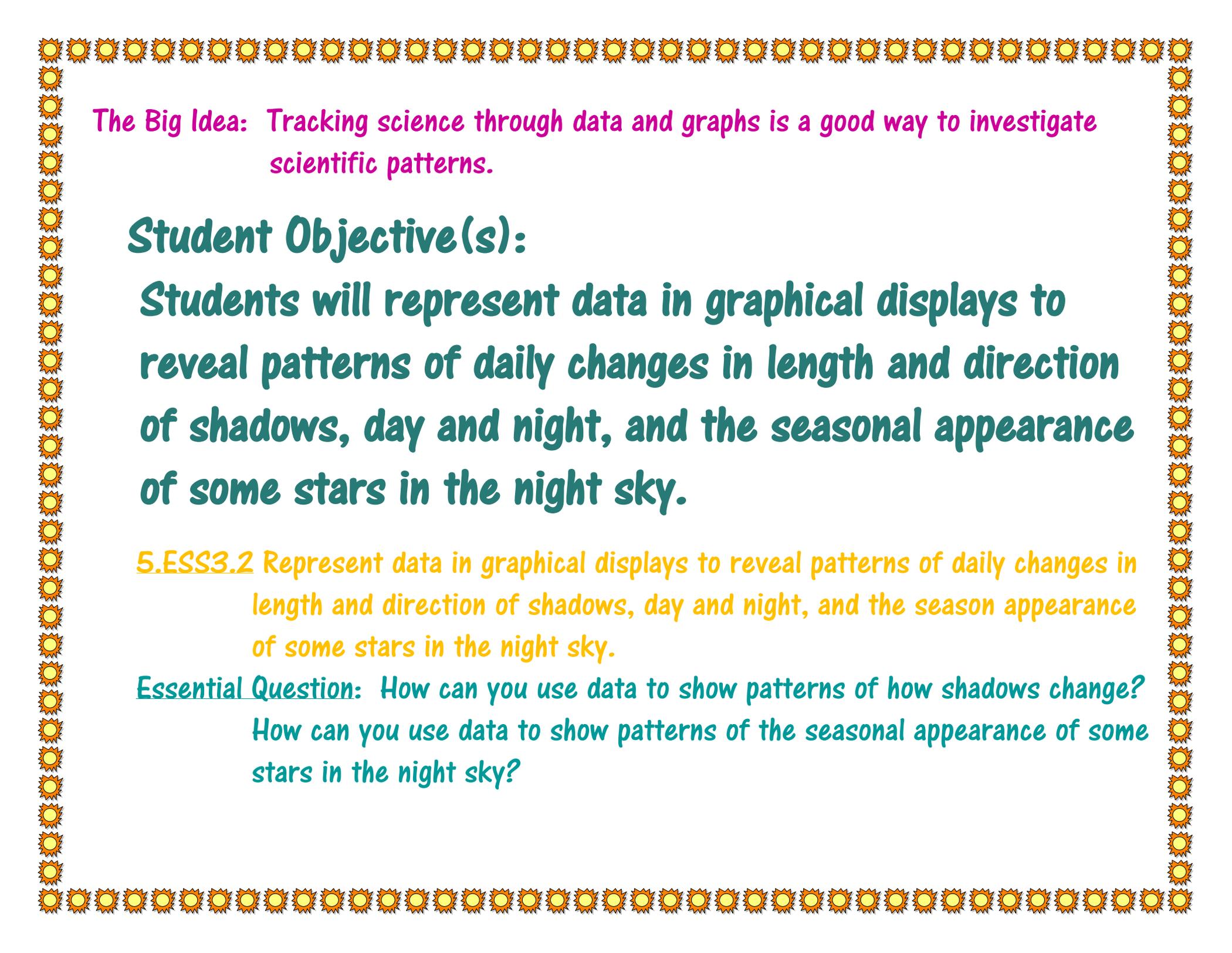
How can you use data to show patterns of the seasonal appearance of some stars in the night sky?



Exit Ticket

How can you use data to show patterns of how shadows change?

How can you use data to show patterns of the seasonal appearance of some stars in the night sky?



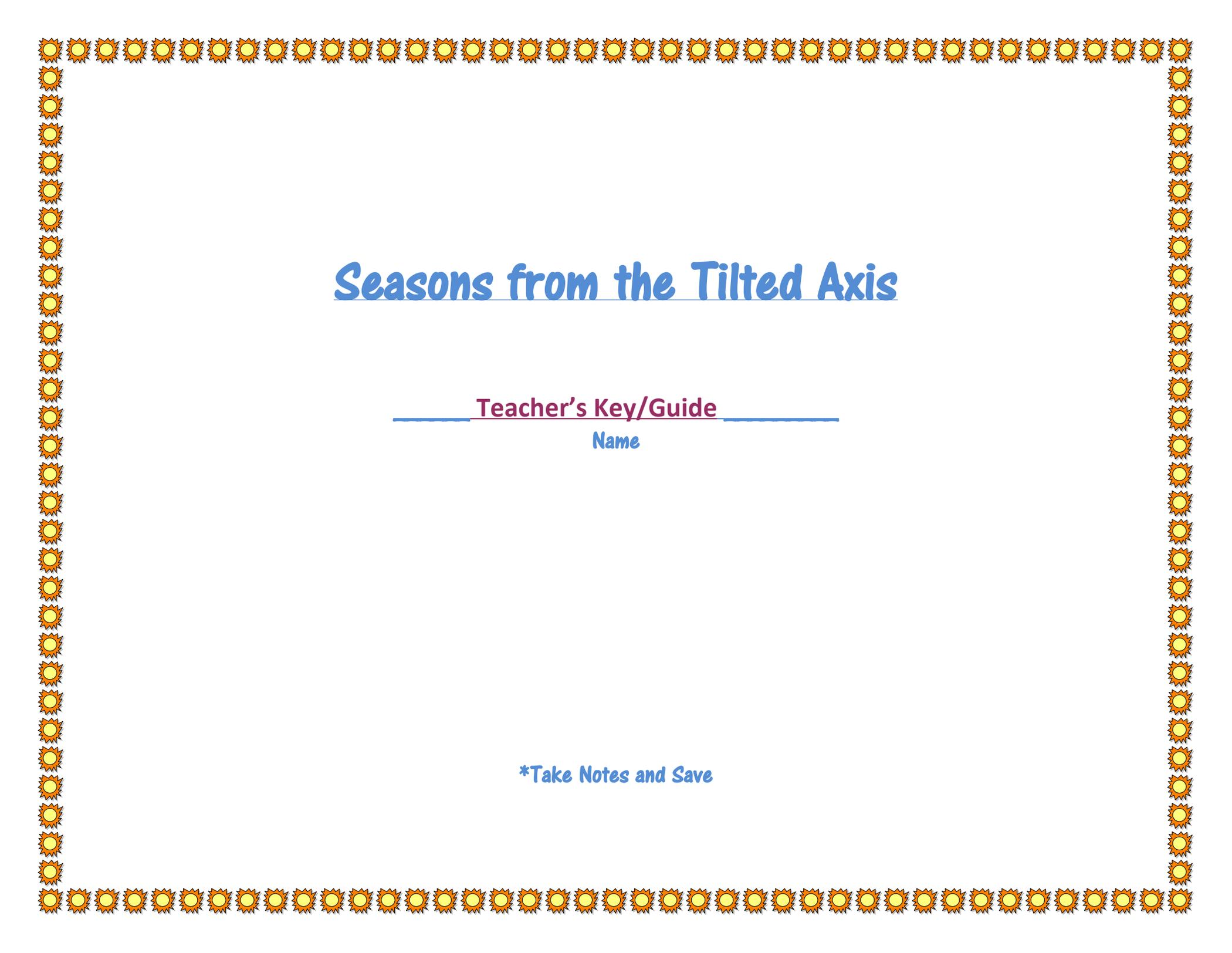
The Big Idea: Tracking science through data and graphs is a good way to investigate scientific patterns.

Student Objective(s):

Students will represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

5.ESS3.2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Essential Question: How can you use data to show patterns of how shadows change?
How can you use data to show patterns of the seasonal appearance of some stars in the night sky?



Seasons from the Tilted Axis

Teacher's Key/Guide

Name

*Take Notes and Save

Key

This week we are going to learn about what makes a season.

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. *Seeing Stars Crash Course 20.1*

Where does the sun go when we can't see it?

The sun doesn't move, we do.

What looks to be the motion of the sun in the sky is really caused by the motion of the Earth.

Describe Earth's rotation.

The Earth turns around on its axis each day.

How many days does Earth's revolution take?

The Earth's revolution takes 365 days.

Because the axis of the Earth is tilted, different parts of the world get different amounts of sun and heat. This causes the Earth to have seasons. If the Earth wasn't tilted, then the world would be one temperature all the time.

What gives us day and night?

The Earth's rotation gives us day and night.

Describe Earth's revolution?

The Earth goes around the sun.

Does the Earth revolve while standing straight up and down?

No. The Earth revolves on a tilted axis.

Take notes from the video and write your own thoughts and ideas.
It goes fast, so be prepared to write fast. Seasons and the Sun Course 11.1

Summer



Circle:

Direct Sunlight

Indirect Sunlight

Describe how this demonstrates the summer sun.

The northern hemisphere is tilted toward the sun. This gives us direct sunlight. This is why the summer is hot.

Winter



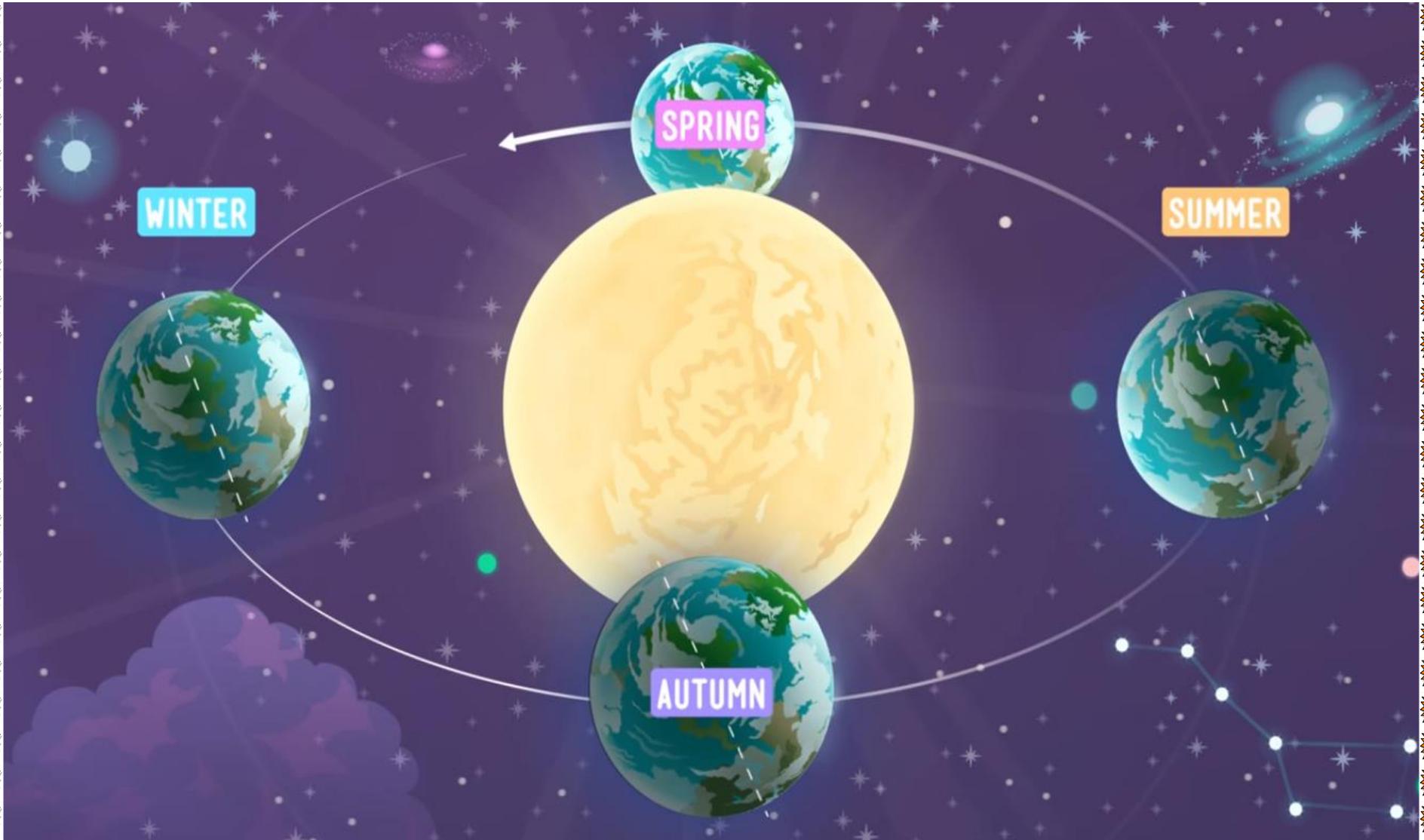
Circle: Direct Sunlight

Indirect Sunlight

Describe how this demonstrates the winter sun.

The northern hemisphere is tilted away from the sun. This gives us indirect sunlight. When the sun isn't directly on our part of Earth, it is colder and the days are shorter.

The Seasons

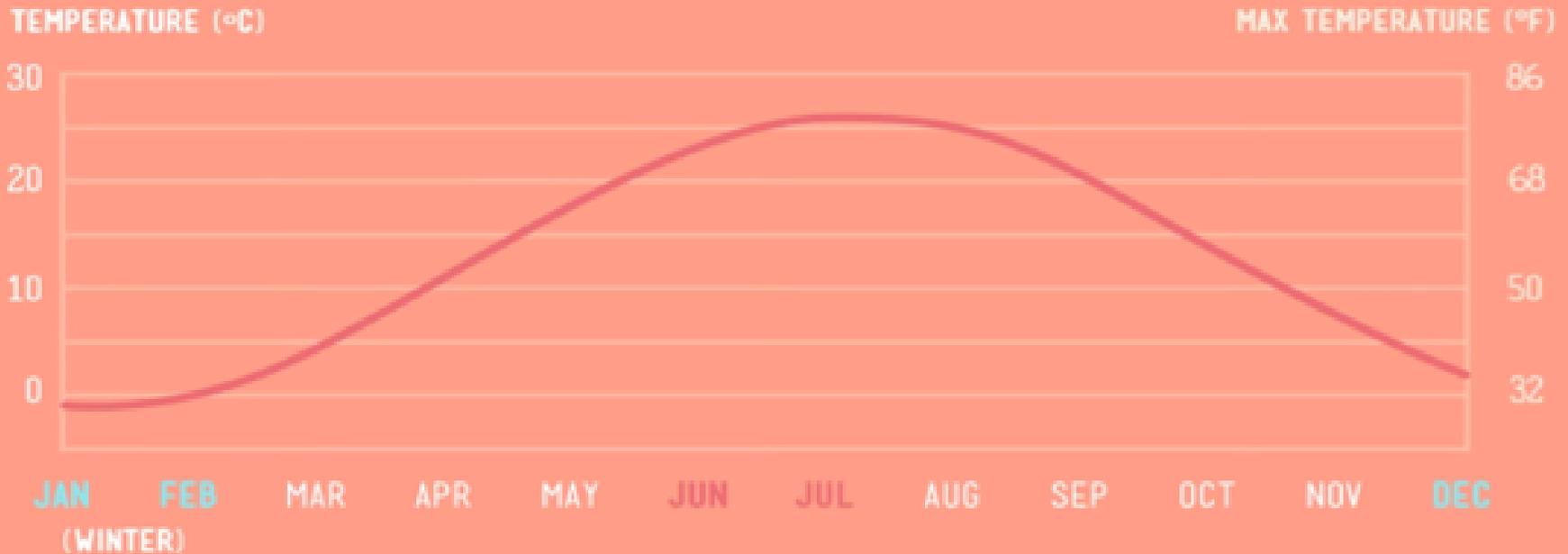


Talk to your partner about how the axis tilt gives the northern hemisphere direct sunlight, indirect sunlight, and some direct sunlight. Discuss each globe. Give the students 3-5 minutes. Encourage to share good ideas that they've heard.

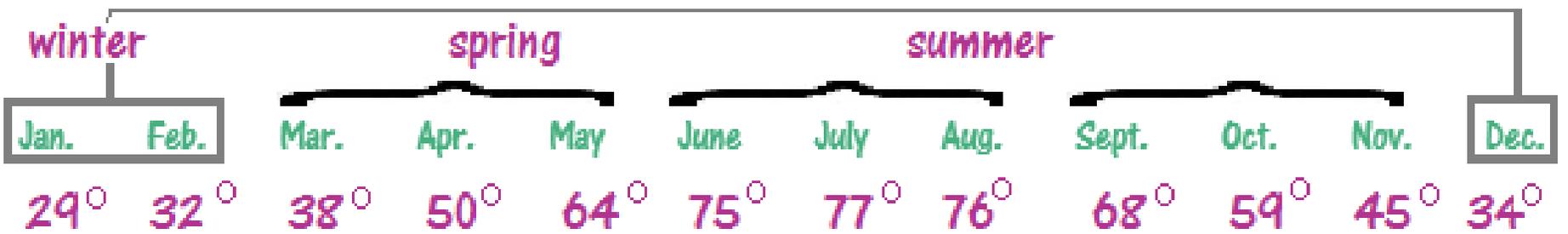
Temperatures Over All the Seasons

AVERAGE HIGH TEMPERATURE

TORONTO, CANADA



Write down the temperatures for the average of each month and discuss with a partner how the sun and the seasons are linked.



Reconstructing Earth Rotation, Revolution, and the Seasons

Activity

Supply: String or yarn, 4 pieces of masking tape, sun sign, and Earth sign

Need Groups of 4

Leader= Reads the directions

Sun- Stands in the middle

Earth- Goes around the sun.

Monitor- Watches to make sure the Earth is following directions.

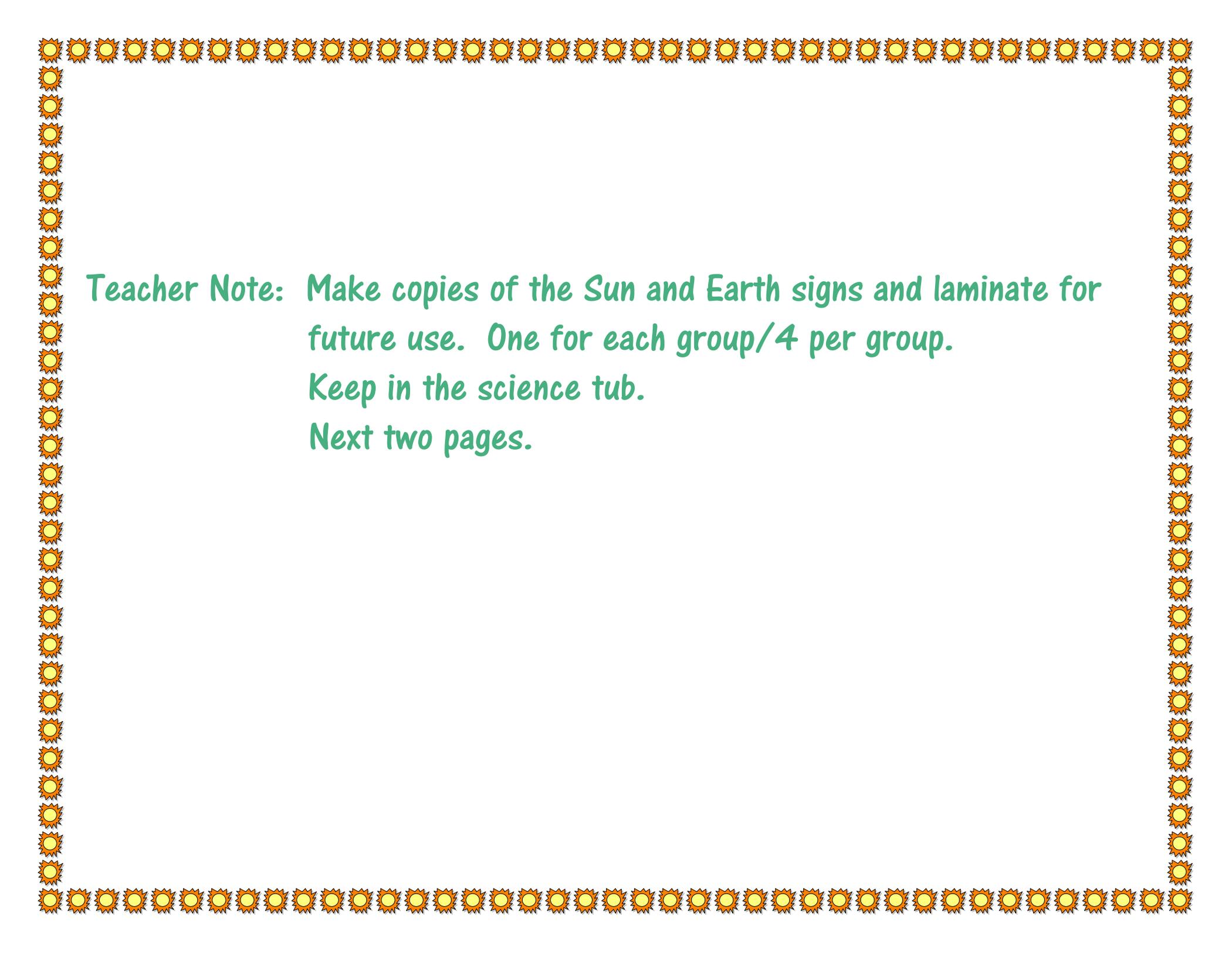
Steps:

1. Select each person's role.
2. Have the sun stand in the middle with the sun sign.
3. The rest of the group will use the string/yarn to mark a large circle around the sun. Hold the string/yarn down with masking tape in quarters.
4. Decide which piece of tape represents each of the seasons.
5. Leader reads the directions.

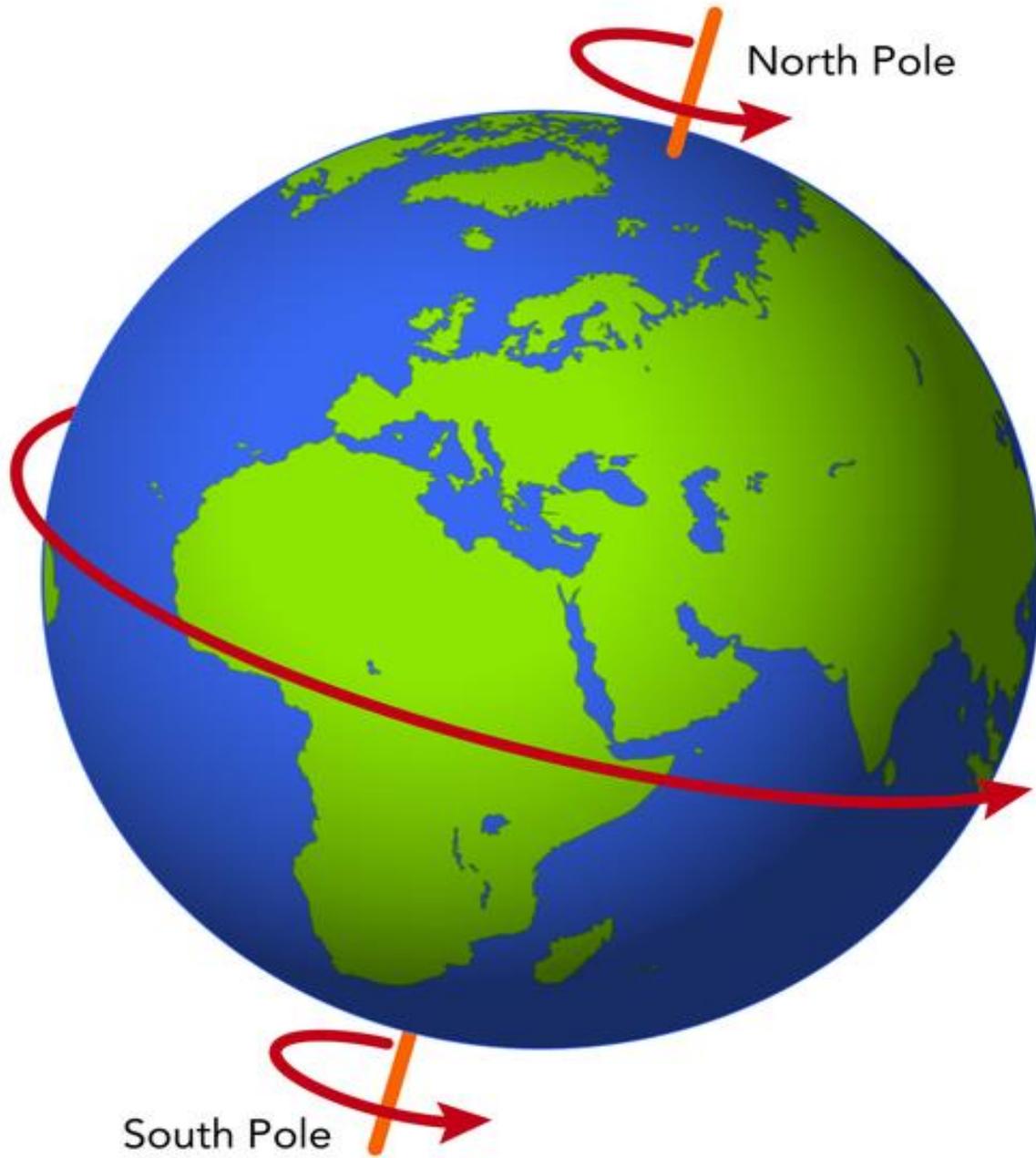
Directions:

- a) The Earth rotates. (Monitor makes sure Earth rotates.)
- b) The Earth rotates and is tilted. (Monitor makes sure Earth stays tilted)
- c) The Earth rotates, is tilted, and revolves around the sun. (Monitor makes sure Earth rotates, tilts, and revolves around the sun.)
- d) The Earth rotates, is tilted, revolves around the sun and calls out "Hot!" for summer, "Nice" for fall, "Burr!" for winter, and "Ahhh!" for spring.

Trade roles. Each person in the group will try each role.



*Teacher Note: Make copies of the Sun and Earth signs and laminate for future use. One for each group/4 per group.
Keep in the science tub.
Next two pages.*



North Pole

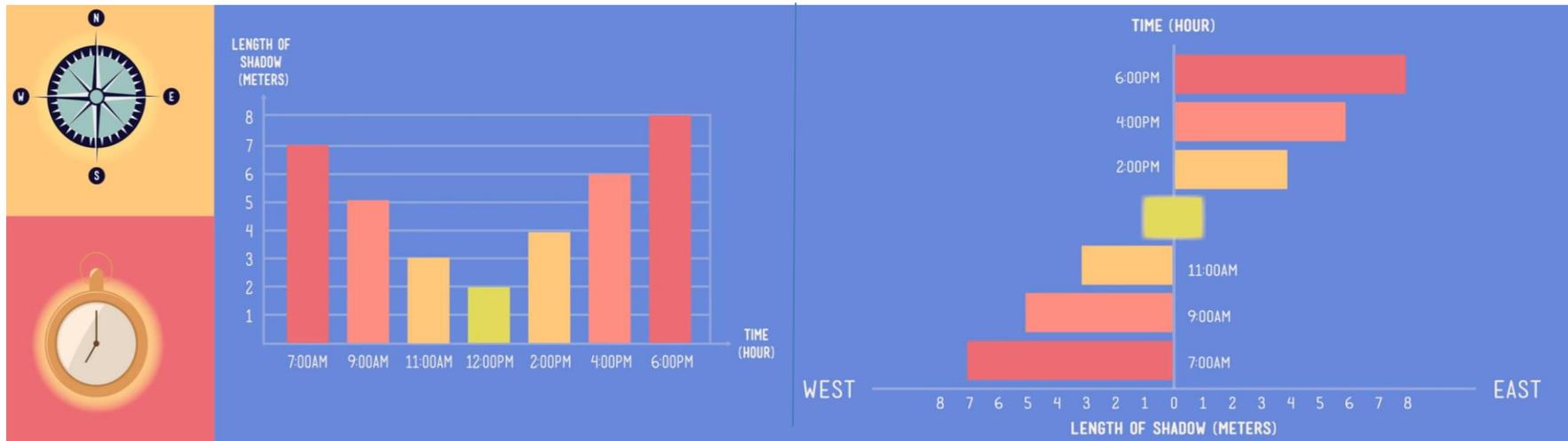
South Pole



Take notes from the video and write your own thoughts and ideas.
It goes fast, so be prepared to write fast. Following the Sun CC 8.2

Describe how ancient Egyptians were able to tell time by watching the sun.

The ancient Egyptians noticed patterns with the sun. The sun went from the east to the west every day. They noticed that the patterns of the shadows followed the same pattern.



How does an object change from the sun?
When the sun is low, the shadows are long.
When the sun is high, the shadows are short.

What is a shadow?

A shadow is a figure or a shape made by an object blocking rays of light. The length and the direction depend on where the sun is located.

What patterns can we discover from charting the length and direction of shadow from morning to evening?

Whatever direction the sun is in the sky, then the shadow will point in the opposite direction.

Shadow Measurement Activity

Objective: Students will gather data on shadow changes.

Choose a method. Measure student shadows or Measure an object.

Supplies:

- chalk and meter/yard stick and ruler, piece of duct tape, compass (download free compass apps on cell), data sheet.

Steps:

1. Students need a partner to help draw the chalk outlines.
2. Find sunny spot outside with direct sunlight.
3. Mark the spot with duct tape where you will stand each time for this experiment.
4. Partner will trace shadow. Measure and write in chalk the measurement.
5. Log each measurement on data sheet. Write unit. (m, ft, yd, etc.)
6. Switch and repeat for partner.
7. When finished, take data to classroom to determine patterns.

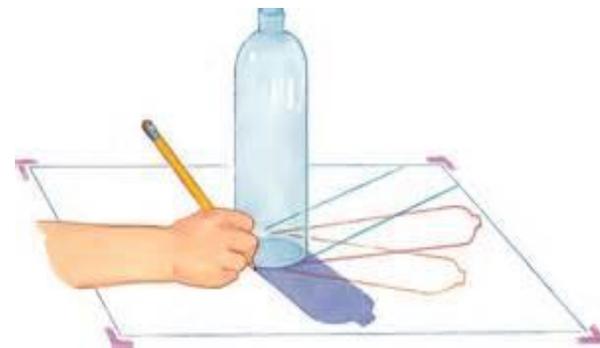


Supplies:

- an object (like a water bottle) to create shadows, butcher paper, duct tape, pencil, ruler/meter stick/yard stick, compass (download free compass apps on cell), data sheet.

Steps:

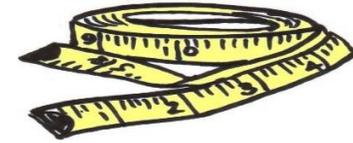
1. Find sunny spot outside with direct sunlight.
2. Tape paper down in direct sunlight. Write your name on your paper.
3. Trace shadow of the object selected. Measure and write the measurement by each trace.
4. Log each measurement on data sheet. Write unit. (in, cm, ft, etc.)
5. When finished, take data to classroom to determine patterns.





Shadow Measurements

Collect Data



What did you measure: _____

Graph 1

Graph 2

Times	Length (give units)	Direction (east or west)
9 a.m. or _____		
10 a.m. or _____		
11 a.m. or _____		
12 p.m. or _____		
1 p.m. or _____		
2 p.m. or _____		

What patterns did you notice?

Shadow Measurements Graphing

Graph 1-These are examples to guide step-by-step. Use your data values from yesterday.

Daily Changes in Length of Shadows

Go to Rapid Tables at <http://www.rapidtables.com/tools/bar-graph.htm>

1. Fill in the form.

2. Graph Title: **Shadow Lengths**

3. Horizontal Axis Label: **Times (9 a.m.; 10 a.m.; 11 a.m.; 12 p.m.; 1 p. m.; 2 p.m.)**

4. Vertical Axis Label: **Lengths (write the unit that you used to measure)**

5. Data Range: **This will be your smallest length to your greatest length.**

6. Number of Bars **6**

7. Bar 1 Data Value: Write the **1st** length.

Bar 1: **First time (ie 9 a.m.)**

8. Bar 2 Data Value: Write the **2nd** length.

Bar 2: **Second time (ie 10 a.m.)**

9. Bar 3 Data Value: Write the **3rd** length.

Bar 3: **Third time (ie 11 a.m.)**

10. Bar 4 Data Value: Write the **4th** length.

Bar 4: **Fourth time (ie 12 p.m.)**

11. Bar 5 Data Value: Write the **5th** length.

Bar 5: **Fifth time (ie 1 p.m.)**

12. Bar 6 Data Value: Write the **6th** length.

Bar 6: **Sixth time (ie 2 p.m.)**

13. Click the bar graph picture to complete the graph.

14. Print or use graph paper to create your own from the graph. For this you will need graph paper and colored pencils.

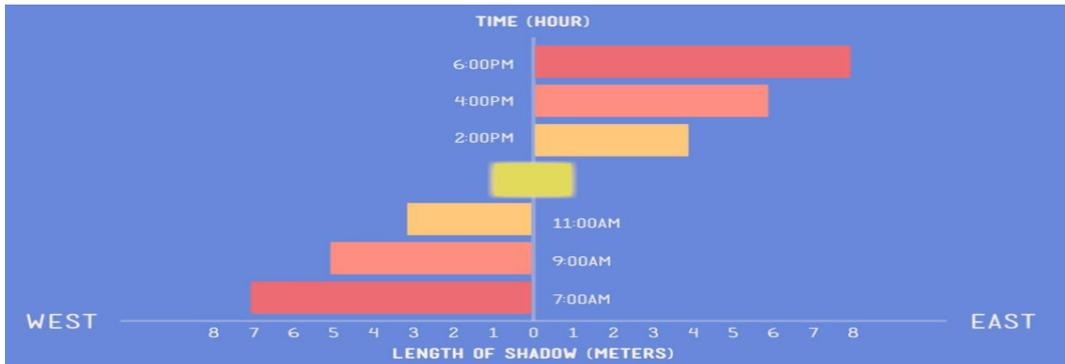
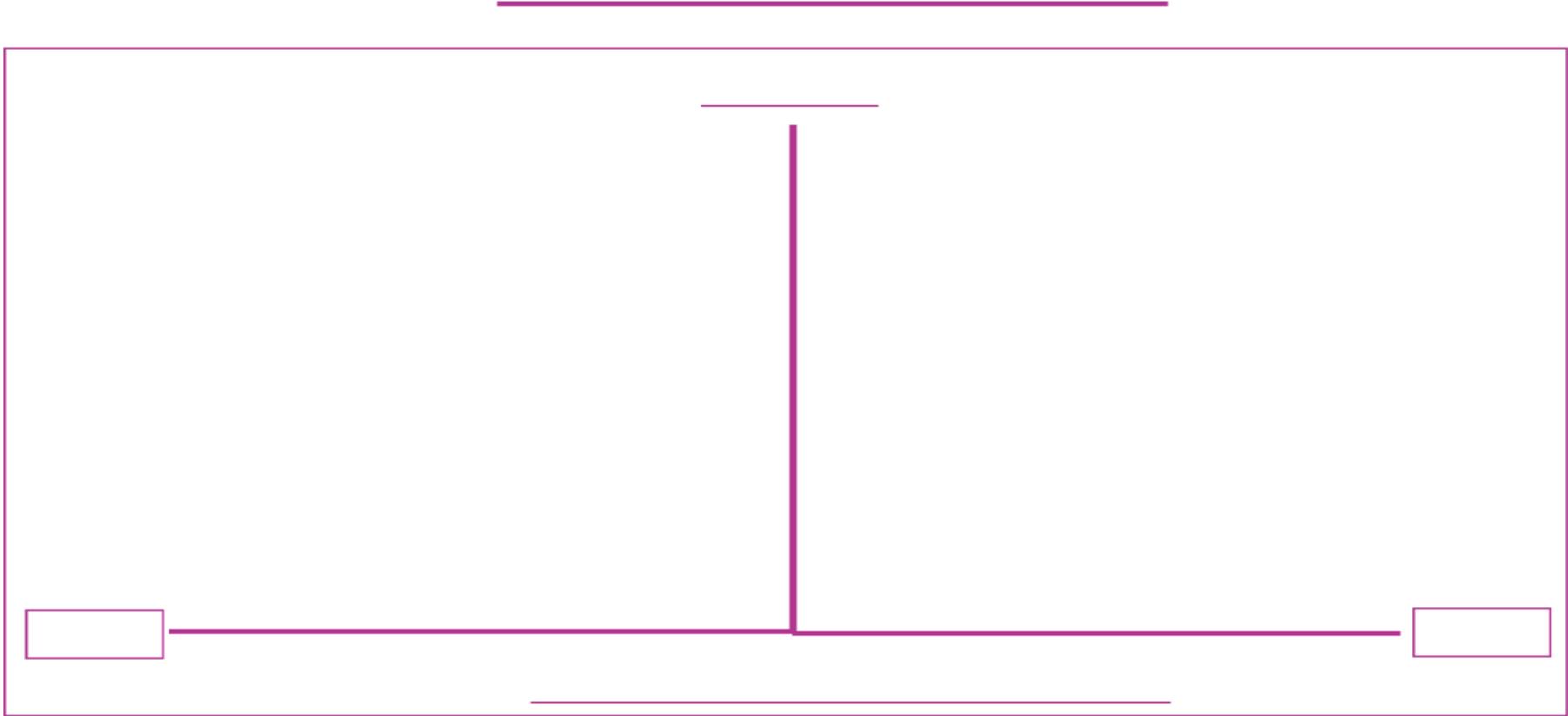
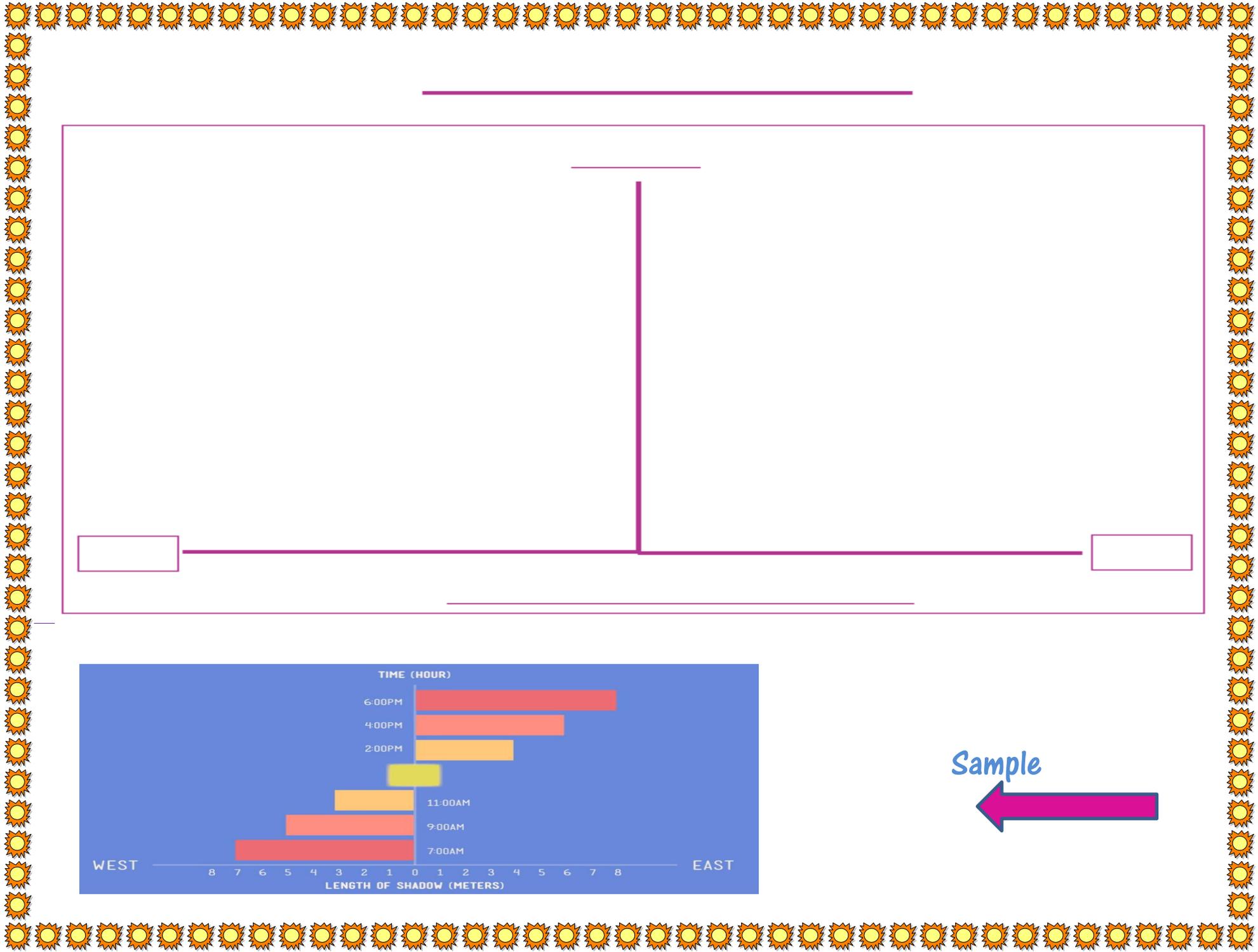
Shadow Measurements Graphing

Graph 2: Use your data values from yesterday.

Daily Changes in Direction of Shadows

Use the template to complete the following.

1. Fill in the title on the top line
2. Vertical axis: On the next line at the top of the graph, label “time”.
3. In the box on the left, write “West”.
4. In the box on the right, write “East”.
5. Horizontal Axis: On the line along the bottom of the graph, label “Length of Shadows in _____” (include units)
6. Label and fill in the graph using your data collected from yesterday. Include:
 - d) Times along the vertical axis
 - e) Lengths along the horizontal axis.
 - f) Draw and color in the bars. (Use straightedge or ruler)



Sample



Key

Take notes from the video and write your own thoughts and ideas.

It goes fast, so be prepared to write fast. Constellation Location Crash Course 31.2

Are all of the constellations always visible from the sky, from everywhere on Earth?

No. We can only see the constellations at different times from different locations.

The constellations that are visible to you depends on two things.

1. Where you are located, the northern hemisphere or the southern hemisphere
2. Which time of the year, or season that you are looking at the sky.

Describe how constellations appear to move across the night sky.

Where the Earth is around the sun affects what season it is, therefore which constellations are visible in the night sky.

The change in stars' position during the night, and over the year is actually a result of the Earth's motion or revolution.

Different constellations or stars appear to move into view in the night sky.

The Big Question!

Explore the constellation sites and review the data below to answer the big question at the bottom.

Talk to your partner about the Zodiac Constellations Data 2015 data below.

What patterns would you be able to determine if you continued to gather data over 10 years?

You would have enough data to determine patterns. (Accept any reasonable answer)

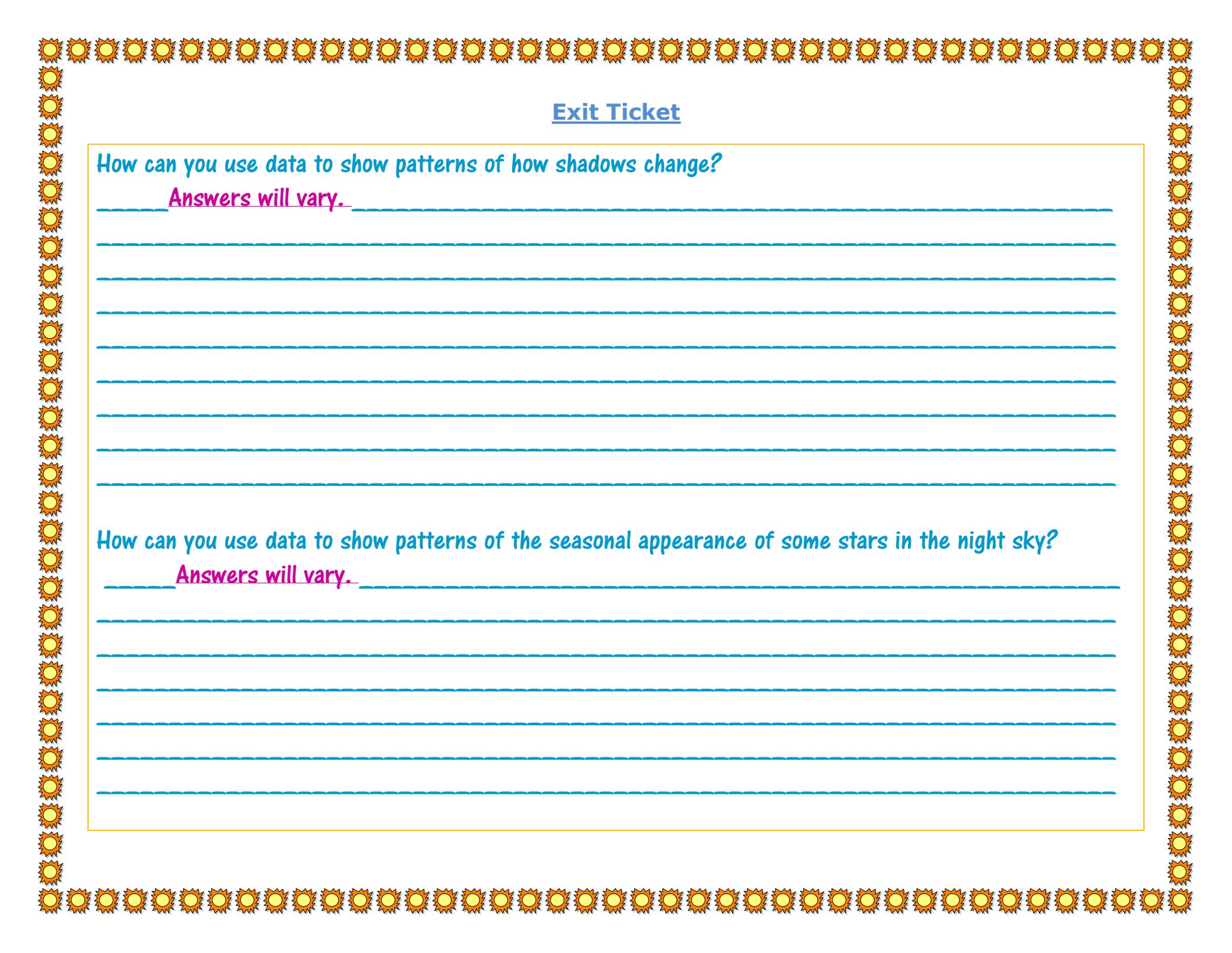
Zodiac Constellations Data 2015

Jan 20, 2015: constellation Capricornus (299.66°)	Aug 11, 2015: constellation Leo (138.13°)
Feb 16, 2015: constellation Aquarius (327.83°)	Sep 17, 2015: constellation Virgo (174.10°)
Mar 12, 2015: constellation Pisces (351.52°)	Oct 31, 2015: constellation Libra (217.75°)
Apr 19, 2015: constellation Aries (29.03°)	Nov 23, 2015: constellation Scorpius (241.08°)
May 14, 2015: constellation Taurus (53.41°)	Nov 30, 2015: constellation Ophiuchus (247.98°)
Jun 22, 2015: constellation Gemini (90.37°)	Dec 18, 2015: constellation Sagittarius (266.55°)
Jul 21, 2015: constellation Cancer (118.20°)	

Answer the BIG QUESTION.

How can you use data to show patterns of the seasonal appearance of some stars in the night sky?

We can use data to show to keep track of patterns of when certain stars appear and when. This makes it more predictable to know when some stars or constellations will appear in the different seasons.



Exit Ticket

How can you use data to show patterns of how shadows change?

Answers will vary.

How can you use data to show patterns of the seasonal appearance of some stars in the night sky?

Answers will vary.

Name Key

Seasons from the Tilted Axis Pre-test/Post Test

Matching questions: Read the term on the left and write the letter that best describes it.

<u>Term</u>	<u>Definition</u>
1. <u>d</u> indirect sunlight	a) This is how long something is.
2. <u>g</u> shadows	b) The imaginary line which goes through the north and south poles and around which Earth spins. It is inclined and tilted 23.5 degrees from a vertical 90 degrees.
3. <u>f</u> Earth's revolution	c) The Earth spins around, or rotates, one full turn each day.
4. <u>a</u> length	d) Sunlight that is not fully facing Earth.
5. <u>e</u> seasons	e) Because the axis of the Earth is tilted, different parts of the world get different amounts of sun and heat causing winter, spring, summer and fall.
6. <u>c</u> Earth's rotation	f) The Earth makes a circle, or revolves, around the sun.
7. <u>b</u> Earth's axis	g) A figure or a shape made by an object blocking rays of light. The length and the direction depend on where the sun is located

Multiple choice questions: Read the description and shade in the bubble of the term that the description describes.

5. Half of the Earth above the equator.

- direct sunlight
- Earth's axis
- pattern
- northern hemisphere

6. A tool that uses the movement of the sun to keep track of time. The shadow cast from the sun tells the time..

- shadows
- sundial
- length
- seasons

7. This is when something happens repeatedly.

- seasons
- pattern
- shadows
- length

8. Sunlight that is straight on Earth.

- sundial
- direction
- direct sunlight
- indirect sunlight

9. This is which way something is goes.

- direction
- sundial
- pattern
- seasons

10. This is how long it takes for the Earth to revolve around the sun.

- 365 days
- sundial
- shadows
- seasons