Integrated STEM Lesson Plan

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Methods of STEM Education

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Topic: Hurricanes
Grade: 3rd Grade
Lesson Time: Approximately five 50-60 minute lessons (one school week)

Essential Question:

- Why is it important to learn about hurricanes?

Lesson Overview and Justification

The purpose of this lesson is to help students learn the basic facts about hurricanes, why they are dangerous, and how to prepare for hurricanes. As an educator and lifelong resident of Florida, I believe it is important for young students, particularly Florida residents, to be informed about hurricanes and their impact. It is not unusual for schools to close due to hurricane watches and warnings.

During the Engage portion of the lesson, a NASA image is used to create interest in the topic, as well as generate a discussion of prior knowledge. A T-W-L chart is used to capture what students think they know and want to learn about hurricanes. Students will refer back to and add information through the 5E process. A NASA eClips Video about hurricanes is used to pique student interest and engage them in the lesson. Select pages of a myON nonfiction text about hurricanes is used to provide students with a text to refer back to and utilize for research. Videos and non-fiction texts will be used throughout the lesson to provide engagement and exploration. Students will ask and answer questions to demonstrate an understanding of the text.

During the Explore portion of the lesson, students will also view a Hurricane 101 video that includes basic facts about hurricanes. After a brief comprehension check, students will utilize an online game, Create-A-Cane, to discover the ideal conditions for hurricanes to form. As students earn or lose points, they build their own understanding. Thus, students must use mathematical reasoning. After students read more pages of the text, they will gain the knowledge necessary to put the stages of a hurricane in order and label the parts of a hurricane. The decision to have students watch the video first was deliberate. Sometimes younger students need a little scaffolding or support prior to exploration activities earlier in the year. As they become more comfortable throughout the school year, they will be more willing to take risks. Feel free to change the order of the activities, as appropriate for your students.

Simulation video will be used during the Explain portion of the lesson to help students learn about the impact of hurricanes. Teams of students will demonstrate their understanding by creating and presenting mini posters that describe the impact of a hurricane category. Students will also participate in a design challenge. Students will have the opportunity to communicate what they've learned via Turn and Talks and Think/Write-Pair-Share opportunities. Students will also analyze historical hurricane tracks, which incorporates the use of math and technology tools. and explain why it is important to track hurricanes. Finally, students will learn about some of the tools weather forecasters use to predict hurricane tracks.

To Extend the lesson and give students an opportunity to explore its implications, students will learn how to prepare for hurricanes. Students will also play a game to decide which items they should include in an emergency kit. To Evaluate student learning, students will use Office 365 tools of their choice to create a presentation about hurricanes. Students will compile the information they gathered from a variety of sources to create a Sway, PowerPoint, brochure, or other presentation to share with others.

Prior Student Knowledge

- Basic understanding of thunderstorms.
- How to read a map key/legend
- Basic computer skills, including the use of presentation tools

Possible Misconceptions

- Hurricanes, cyclones, and typhoons are different.
- Children do not need to be concerned with hurricane preparation.

NGSS and CCSS STANDARDS

3-ESS2 Earth's Systems

Students who demonstrate understanding can:

- 3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 3-ESS2-2. Obtain and combine information to describe climates in different regions of the world

<u>Science and Engineering Practices</u>

Obtaining, Evaluating, and Communicating Information

- Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
    - Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)

<u>Disciplinary Core Ideas</u>

ESS2.D: Weather and Climate

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)
- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)

Cross-Cutting Concepts

Patterns

- Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2)

Common Core State Standards Connections:

ELA/Literacy

- RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2)
- RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2)
- W.3.9 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3- ESS2-2)

Mathematics

- MP.2 Reason abstractly and quantitatively. (3-ESS2-1),(3-ESS2-2)
- MP.5 Use appropriate tools strategically. (3-ESS2-1)

OBJECTIVES

By the end of each lesson, students will be able to:

Engage

- Define hurricane.

Explore

- Distinguish between true and false statements about hurricanes.
- Infer the ideal conditions for a hurricane to form.
- Describe the stages of a hurricane.
- Label the parts of a hurricane.

Explain

- Create a mini poster that represents the effects of a hurricane based on its category.
- Design and build a tower able to withstand simulated hurricane force winds.
- Conclude why it is important to track hurricanes.
- Analyze actual hurricane data and determine the likely effects of the hurricane.
- Explain how NASA helps make forecasting hurricanes more accurate.

Elaborate

- List ways to prepare for a hurricane.
- Decide which items are needed for an emergency kit.

Evaluate

- Compile information from multiple sources to create a presentation about hurricanes.

ENGAGE

Materials/Resources Needed

- Teacher: chart paper, markers; NASA image of a hurricane, NASA eClips Video: What is a Hurricane?, myON book - Smithsonian Little Explorer Series. Hurricanes by Martha E.H. Rustad
- Individual students: post-it notes, pencils, What is a hurricane? exit ticket?, *Hurricanes* reading notes

Preparation

- Set up a "What do you see?" chart paper.
- Set up a T-W-L Chart. Students will post what they think they know (T), want to learn (W), and learned about soil (L).
- Internet access

Vocabulary

hurricane, weather, meteorologist, scientist, prediction, NASA

Instructional Sequence

1. Display a NASA image of a hurricane. Ask: What do you see?
    a. https://apod.nasa.gov/apod/image/0508/katrina_goes12.jpg
    b. Allow students to share their observations.
    c. Record their observations on a class chart.

2. T-W-L Chart (whole class)
    a. Have students write what they think they know about hurricanes on post-it notes and place the notes under the T.
    b. Have students write what they want to learn about hurricanes on post-it notes and place the notes under the W. As appropriate, revise the lesson plan to incorporate what students want to learn.
    c. Say: As you learn facts about natural disasters the next few days, remember to check to see if what you thought about severe weather was correct or not.
    d. As students' questions are answered throughout the lesson, have students write what they've learned about hurricanes on post-it notes and place the notes under the L. At the end of the lesson, have students record additional learning.

3. NASA eClips Video
    a. Our World: What is a hurricane?
    b. https://nasaeclips.arc.nasa.gov/video/ourworld/our-world-what-is-a-hurricane
    c. Class Discussion
        - What is a hurricane?
        - Where do they form?
        - What are other names for hurricanes?
        - What four things do meteorologists need to know to predict hurricanes?

- What three things do steering winds control?
- Where do meteorologist receive data from?

4. myON book – *Smithsonian Little Explorer Series. Hurricanes* by Martha E.H. Rustad
    a. Read pages 4 – 5.
    b. Turn and Talk: What is a hurricane?
    c. Ask: What are two other names for hurricanes?

5. Lesson Closure
    a. Ask: What did you learn about hurricanes today?
    b. Give students an opportunity to add post-it notes under the L on the T-W-L chart.
    c. Say: During the next lesson, you will learn how hurricanes form.
    d. Exit Ticket: What is a hurricane?

EXPLORE

Materials/Resources Needed

- Teacher: T-W-L chart, markers, Hurricanes 101 – National Geographic Video, myON book - *Smithsonian Little Explorer Series. Hurricanes* by Martha E.H. Rustad
- Individual students: post-it notes, pencils, a slip of red and green construction
- Each group: Stages of a Hurricane? baggie and activity sheet, glue, Parts of a Hurricane handout, Computer or personal device, Create-A-Cane handout

Preparation

- Stages of a Hurricane – Cut apart each cell and place each piece into a baggie (12 pieces); Mix up the pieces.
- Cut pieces of red and pieces of green construction paper (about 2 x 3 inches). Each student will need 1 red and 1 green piece of paper.
- Internet access

Vocabulary

tropical disturbance, tropical depression, tropical storm, hurricane, wind, latitude, atmosphere, moisture, temperature

Instructional Sequence

1. Class Review
    a. Revisit the T-W-L chart.
    b. Check the Ts for any misconceptions.
    c. Mark the Ws that have been addressed.
    d. All students to share their Ls.
    e. Say: In this lesson, you're going to answer two questions: What causes a hurricane to form? What are the stages of hurricanes?

2. Hurricanes 101 – National Geographic
    a. https://www.youtube.com/watch?v=zP4rgvu4xDE
    b. True or False:
        - Provide each student with a red and green slip of construction paper.
        - If a student believes the statement is true, s/he will hold up the green paper.
        - If a student believes the statement is false, s/he will hold up the red paper.
            - Wind, rain, and waves are the hallmarks of a hurricane
            - Hurricanes form in the summer and fall
            - Hurricanes release as much energy as several atomic bombs.
            - They eye wall is the most dangerous part of the storm.
            - Most hurricanes hit North America.
            - Storm surges is one of the most dangerous effects of a hurricane.
            - Hurricane hunters fly directly into hurricanes.

3. Create A Cane – National Hurricane Center and NOAA Activity
    a. Review the terms *wind, latitude, atmosphere, moisture, temperature*
    b. Have students work in pairs to complete the Create-A-Cane Activity.
    c. In this activity, students will create their own hurricanes by discovering the ideal conditions for a hurricane to form by changing the wind direction, latitude range, moisture in the atmosphere, and see temperature.
    d. http://www.nhc.noaa.gov/outreach/games/canelab.htm

4. Stages of a Hurricane Activity
    a. Read *Smithsonian Little Explorer Series: Hurricanes* by Martha E.H. Rustad, pages 6 – 11 in myON.
    b. Have students work in teams of 3 – 4 students.
    c. Provide each team with a baggie, group activity sheet, and glue.
    d. Each team will also complete the Parts of a Hurricane handout.

5. Lesson Closure
    a. Ask: What did you learn about hurricanes today? What conditions are necessary for hurricanes to form? What are the stages of a hurricane? What questions do you still have about hurricanes?
    b. Give students an opportunity to add post-it notes under the W and L on the T-W-L chart.
    c. Say: During the next lesson, you will learn about the effects of hurricanes and why it is important to track them.

EXPLAIN

Materials/Resources Needed

- Teacher: T-W-L chart, markers, Hurricane Storm Surge Video, Hurricane Phoenix: The Tampa Bay Region's Worst Case Scenario Video, Discovery Education Connect with Weather video
- Individual students: post-it notes, pencils, index cards
- Each group: 12x18 white construction paper, art supplies, Historical Hurricane Tracks handout, computer or personal device

Preparation

- Familiarize yourself with the NHS NOAA Hurricane Historical Data website.
- Internet access

Vocabulary

hurricane track, storm surge, weather forecast, SLOSH, NASA

Instructional Sequence

1. Class Review
    a. Revisit the T-W-L chart.
    b. Check the Ts for any misconceptions.
    c. Mark the Ws that have been addressed.
    d. All students to share their Ls.
    e. Ask: What can happen if a hurricane hits land? Allow students to share their thinking.
    f. Say: Today you are going to learn about the effects of hurricanes and why it is important to track them.

2. myON book – *Smithsonian Little Explorer Series. Hurricanes* by Martha E.H. Rustad
    a. Read pages 16 – 17.
    b. Turn and Talk: What types of damage can hurricanes cause?

3. Hurricane Storm Surge Video
    a. https://oceantoday.noaa.gov/hurricanestormsurge/welcome.html
    b. Class Discussion
        - What is the greatest threat to life during a hurricane?
        - What is storm surge?
        - What kind of damage can storm surge cause?
        - What is SLOSH?

4. Mini Poster
    a. Divide the class into 5 teams. Assign each team a hurricane category.
    b. Show the Connect with Weather video
        - Simulation of Categories 1 – 5
        - http://www.discoveryeducation.com/connectwithweather/

c. Have each team create a mini poster to show the effects of a hurricane according to its assigned category.
d. The mini poster must also include labels and/or captions to describe the impact of a hurricane.

5. Design Challenge
    a. Students can work in teams to participate in an engineering design challenge to build a tower as tall as possible that will hold up a tennis ball while resisting the force of wind from a fan. The towers can be tested at different simulated wind speeds (from the fan) based on the data about different categories of hurricanes.
    b. Source: https://pmm.nasa.gov/education/interactive/building-hurricanes-engineering-design-challenge

6. Hurricane Tracking
    a. Hurricane Phoenix: The Tampa Bay Region's Worst Case Scenario Video
        - A video simulation of a Category 5 hurricane making a direct landfall on the Tampa Bay metro area.
        - https://www.youtube.com/watch?v=7jFGEzYam40
    b. Think/Write – Pair – Share
        - Provide each student with an index card.
        - Say: Think about the effects of hurricanes you have learned about.
        - Ask: Why is it important to track hurricanes?
    c. Explain that weather forecasters track hurricanes to predict when and where hurricanes will make landfall. This will give families plenty of time to prepare for the hurricane.
    d. Historical Hurricane Tracks
        - Go to https://coast.noaa.gov/hurricanes/
        - Demonstrate how to use the Search engine on the left side of the page to search hurricanes by Name/Year.
        - Whole Class
            - Model how to use the search engine to find the hurricane track data for Hurricane Jeanne 2004 and complete the Historical Hurricane Tracks handout.
            - Display on the document camera as the handout is completed.
        - Small Group – Assign teams of students to view the hurricane track data and complete the handout for their assigned hurricane.
            - Group 1 – Matthew 2016
            - Group 2 – Hermine 2016
            - Group 3 – Charley 2004
            - Group 4 – Katrina 2005
            - Group 5 – Frances 2004
            - Group 6 – Ivan 2004

7. How NASA Helps Improve Hurricane Forecasting Video
    a. https://www.accuweather.com/en/videos/how-nasa-helps-improve-hurricane-forecasting/1mnmjyote6x5rvrqnswv-6oafaoogx8g?SearchForm-input=hurricane
    b. Read *Smithsonian Little Explorer Series: Hurricanes* by Martha E.H. Rustad, pages 26 – 27 in myON.
    c. Turn and Talk: How does NASA help make forecasting hurricanes more accurate?
    d. Record key information on an anchor chart.

6. Lesson Closure
    a. Allow teams to share their mini posters.
    b. Ask: Why is it important to track hurricanes? How does NASA help weather forecasters? What questions do you still have about hurricanes?
    c. Give students an opportunity to add post-it notes under the W and L on the T-W-L chart.
    d. Say: During the next lesson, we will focus on how to prepare for hurricanes.

EXTEND / ELABORATE

Materials/Resources Needed

- Teacher: T-W-L chart, markers, Hurricane Survival Video
- Individual students: post-it notes, pencils
- Each group: How to Prepare for a Hurricane handout, computer or personal device,
    - *Hurricanes* by Schuh, Mari C.
    - *Hurricanes: Be Aware and Prepare* by Gray-Wilburn, Renée
    - *Hurricanes!* by Aboff, Marcie

Preparation

- Internet access

Vocabulary

hurricane watch, hurricane warning, prepare, evacuate

Instructional Sequence

1. Class Review
    a. Revisit the T-W-L chart.
    b. Check the Ts for any misconceptions.
    c. Mark the Ws that have been addressed.
    d. Allow students to share their Ls.
    e. Ask: Have you ever experienced a hurricane? How did your family prepare for the hurricane? Allow students to share their experiences.
    f. Say: Today you will learn about how to prepare for a hurricane.

2. How to Prepare for a Hurricane
    a. Assign each student a reading partner.
    b. Provide each pair with a How to Prepare for a Hurricane Handout. Explain that each pair will read a book that includes information they've already learned about hurricanes, as well as information about how to prepare for a hurricane. They will take notes about how to prepare for hurricanes on the handout.
    c. Allow each pair to choose a book to read. More than one group can read the same text.
        - *Hurricanes* by Schuh, Mari C.
        - *Hurricanes: Be Aware and Prepare* by Gray-Wilburn, Renée
        - *Hurricanes!* by Aboff, Marcie
    d. Allow students to share their notes with the class. Students may add to their notes as they listen to their classmates.

3. Hurricane Survival Video
    a. https://oceantoday.noaa.gov/hurricanesurvival/welcome.html
    b. Class Discussion
        - When should you start preparing for a hurricane?
        - What are the 3 Steps?
        - What does a hurricane watch mean?
        - What should you do if a hurricane watch is issued?
        - What does a hurricane warning mean?
        - What should you do if a hurricane warning is issued?
        - What does it mean to evacuate?

4. Build a Kit
    a. https://www.ready.gov/kids/games/data/bak-english/index.html
    b. Students play a game to determine what they need for an emergency kit.

5. Lesson Closure
    a. Allow teams to share the items they included in their emergency kits.
    b. Ask: How can you prepare for a hurricane? What questions do you still have about hurricanes?
    c. Give students an opportunity to add post-it notes under the W and L on the T-W-L chart.
    d. Say: Next, you will create a visual presentation to share what you have learned about hurricanes.

EVALUATE

Task: Create a Hurricane Presentation in Office 365.

Presentation Options: Sway, PowerPoint, Brochure, Booklet

Directions:

- You may use any of the hurricane books available in myON and other teacher-approved reliable sources to conduct your research.
- Each section should have a heading.
- Use correct grammar, capitalization, spelling, and punctuation.
- Include graphics that match the text.

Required Content:

- Definition of a hurricane
- Hurricane season in Florida
- Conditions necessary for a hurricane to form
- Stages of a hurricane
- Saffir-Simpson Hurricane Scale
- Effects of hurricanes
- Tools used to track hurricanes
- Hurricane Safety
- Hurricane watch vs. Hurricane warning
- How to prepare for a hurricane
- Other interesting facts (student choice)
- Sources

EXIT TICKET

Name _____

What is a hurricane?

_____

_____

_____

EXIT TICKET

Name _____

What is a hurricane?

_____

_____

_____

CREATE-A-CANE!

Activity

Names _____

Directions:

- Go to the website:
- Follow the directions on each page.
- Click on the "help" button for hints.
- Complete the sentences in each section as you discover the ideal conditions for a hurricane to form.
- You must earn a total of 100 points to create your own hurricane.

EXIT TICKET

Name _____

What is a hurricane?

_____

_____

_____

Winds

1. The winds need to blow from the _____ direction at all levels.
2. The upper-, mid-, and low-level winds need to be _____ or _____.

Latitude Range

3. Hurricanes cannot form in areas too close or too far from the equator. The latitude range is between _____˚ N and _____ ˚ N.

Atmospheric Layers

4. The upper layer of the atmosphere can be dry or moist. The middle and lower layers of the atmosphere must be _____.

Sea Temperature

5. The sea temperature must be above 80˚ F or _____ ˚ C

STAGES OF A HURRICANE

Baggie Pieces

up to 22 miles per hour	tropical disturbance	A small thunderstorm forms over very warm ocean waters.
23 to 38 miles per hour	tropical depression	The storm pulls more ocean water up into it. More rain falls and winds become stronger. The storm begins to spin around a calm center.

39 to 73 miles per hour	tropical storm	A tropical depression may grow into this type of storm.
74 miles per hour or more	hurricane	A tropical storm may grow into this type of storm.

STAGES OF A HURRICANE

Group Activity Sheet

Names _____

Directions:

- Use the pieces in the baggies to complete the chart.
- The pieces must be placed in the correct order of a hurricane's development.
- After your team comes to an agreement about where each piece belongs on the chart, glue the pieces to your chart.

Wind Speed	Type of Storm	Description

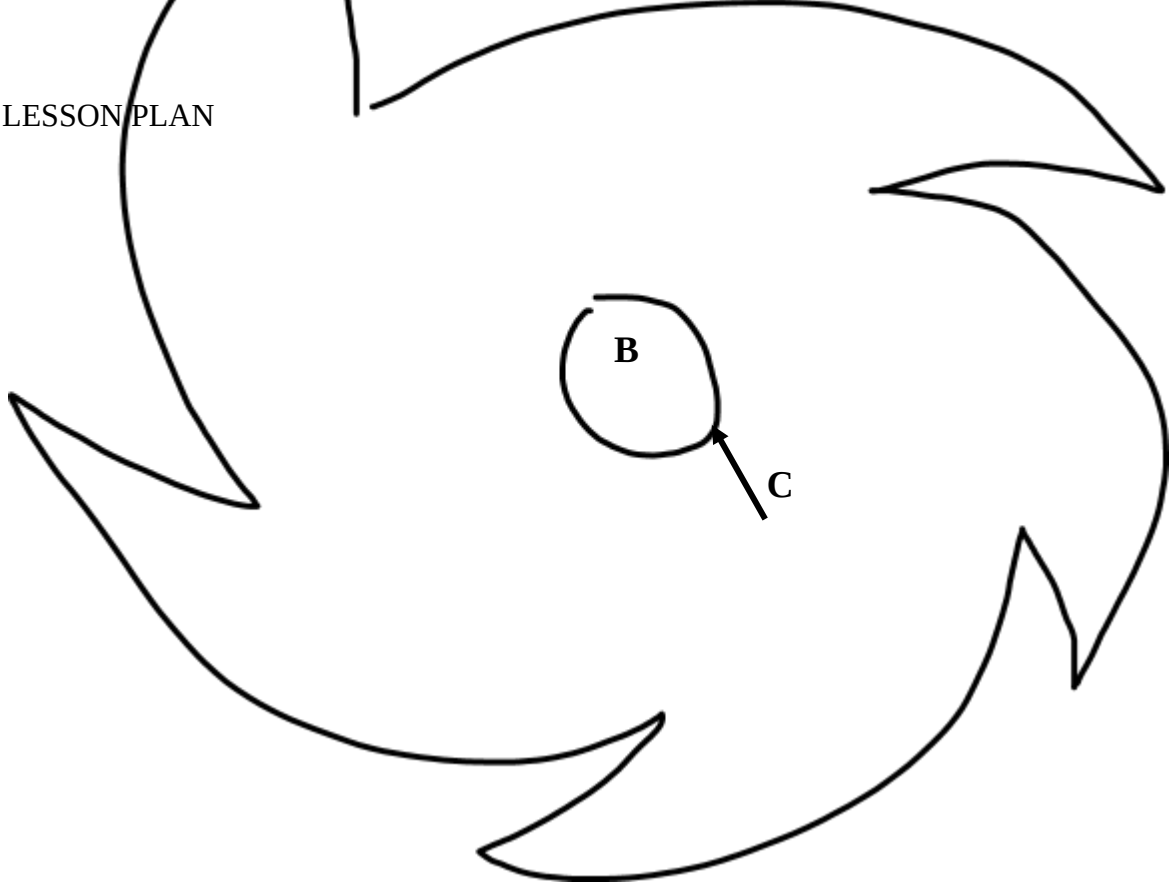
PARTS OF A HURRICANE

Name _____

Directions:

- Label the parts of a hurricane.

A



A _____ (thunderstorms and clouds that spiral)

B _____ (the center; calm area)

C _____ (the strongest part of the storm)

HISTORICAL HURRICANE TRACKS

Directions:

- Go to the website.
- Search by Name/Year
- Click on “View Legend” to see what type of storm each color represents.
- Answer the questions below about your assigned hurricane.

Questions:

1. What is the name and year of your hurricane?

   _____

2. What was the greatest strength of this hurricane?

   _____

3. Based on its strength, what do you think were the effects of the hurricane? (Worth 3 pts.)

_____

_____

_____

_____

_____

4. Write two or more observations can you make about this storm's track? (Worth 2 pts.)

_____

_____

_____

_____

HOW TO PREPARE FOR A HURRICANE

Notes

Book Title _____

Author _____

- _____
- _____
- _____
- _____
- _____

- _____
- _____
- _____
- _____

Hurricane Survival Video Notes

- Step #1 _____
- Step #2 _____
- Step #3 _____
- A hurricane _____means hurricane conditions are possible in a specific area within the next 48 hours.
- A hurricane _____ means a hurricane is expected to hit a specific area in 36 hours or less.

ASSESSMENT CRITERIA

NOTE: Adjust based on approved grading criteria in your school or district.

Exit Ticket Grading Criteria

√+ - Exceeds Expectations – The definition is complete and includes key words, such as spinning and storm; The definition also includes other names for hurricanes (cyclones and typhoons).

√ - Meets Expectations – The definition is complete and includes key words, such as spinning and storm

X – Below Expectations – The definition is incomplete. It does not include the word storm.

Create-A-Cane

Students will score an 80% (4/5) or higher.

Stages of a Hurricane and Parts of a Hurricane

Students will score a 73% (11/15) or higher.

Historical Hurricane Tracks

Students will score 71% (5/7) 0r higher.

How to Prepare for a Hurricane Notes Rubric

Grades	Criteria
Excellent	All of the book and video notes are complete and accurate.
Satisfactory	Most of the book and video notes are complete and accurate. The notes are missing a few important details and/or contain 1-2 errors.
Needs Improvement	Some of the book and video notes are complete and accurate. The notes are missing some important details and/or contain 3-4 errors.
Unsatisfactory	The book and video notes are incomplete or inaccurate. The notes are missing several important details and/or

	contain 5 or more errors.

CRITERIA	4	3	2	1
Content **(x4)**	**All** of the required content is **complete** and **accurate**:	**Most** of the required content is complete and accurate. A few key pieces of important information are missing or inaccurate.	**Some** of the required content is complete and accurate. Several key pieces of important information are missing or inaccurate.	**Little** of the required content is complete and accurate. Most key pieces of important information are missing or inaccurate.
Format	Each section has an appropriate **heading.**	**Most** of the sections have appropriate headings.	**Some** of the sections have appropriate headings.	**Few** or no headings were included
Language Skills	There are **virtually no errors** in grammar**,** capitalization, spelling, or punctuation that distract the reader.	There are **some errors** in grammar**,** capitalization, spelling, or punctuation that distract the reader.	There are **several errors** in grammar**,** capitalization, spelling, or punctuation that distract the reader.	There are **serious** and **numerous errors** in grammar**,** capitalization, spelling, or punctuation that distract the reader.
Presentation	All of the graphics are **visually attractive** and **appropriate** for the text.	**Most** of the graphics are visually attractive and appropriate for the text. .	**Some** of the graphics are appropriate for the text. Other graphics are visually distracting.	Little to no graphics were included. Graphics are not related to the text.
Due Date			The presentation was submitted **on or before the due date.**	The presentation was submitted **after the due date.**

Hurricane Presentation Rubric

Possible Points: 30