



Lesson 5 - Frozen Precipitation

Hail

Estimated Lesson Time: 40 minutes

Introduction

Every year, hail causes injury to people and livestock, as well as damage to houses and crops. The different ways precipitation forms determines what type of precipitation it becomes. Hail is larger than sleet, and forms only in thunderstorms. Hail formation requires air moving up (thunderstorm up-draft) that keeps the pieces of ice from falling. Drops of supercooled water hit the ice and freeze on it, causing it to grow. When the hailstone becomes too heavy for the updraft to keep it aloft, or it encounters downdraft air, it falls.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a supercooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape resulting in a layer of clear ice.

Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice.

Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are “balanced” in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting the layers. Hailstones can begin to melt and then re-freeze together - forming large and very irregularly shaped hail.

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Fun Fact:

The largest hailstone diameter recorded in Oklahoma was 6 inches on May 23, 2011.

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Activity: Sizing Up Hail

Materials

A cardboard box big enough to fit all the hail balls in with lid, copies of handout “Sizing Up Hail” for each member, and several different sized balls made of wood or styrofoam. 3 - ½” balls, 3 - ¾” balls, 3 - 1” balls, 3 - 1¼” balls, 2 - 1½” balls, 2 - 1¾” balls, 2 - 2” balls, 2 - 2½” balls, 1 - 3” ball, 1 - 3½” ball, and 1 - 4” ball. Can be bought at craft store.

Objective and Overview

The students will be able estimate the size of hail based upon samples picked at random.

Preperation and Procedure

Acquire the balls at a local fabric and/or hardware store. Number the balls with random values (i.e. 1-10) not associated with the size. Record each number and size on your answer key (page 3). Place the balls in a box and close the box leaving an opening just large enough to pull the largest ball out of the box. Collect balls of the following quantities and sizes: 3 - ½” balls, 3 - ¾” balls, 3 - 1” balls, 3 - 1¼” balls, 2 - 1½” balls, 2 - 1¾” balls, 2 - 2” balls, 2 - 2½” balls, 1 - 3” ball, 1 - 3½” ball, and 1 - 4” ball.

Choose a student to select balls from the box. Once the ball is selected, have the student tell the class the number on the ball. The students should write that number on their paper. Pass the ball around allowing the students to hold it and estimate the ball’s diameter in inches. Once everyone has written their estimates, place it aside. Have each student write their estimated size of the hailstone next to the ball’s number on the worksheet.

Repeat the procedure with the next ball chosen from the box. (You can save time by allowing several balls to be passed at the same time.) Once the last estimate has been made, tell the students the actual dimensions of each ball.

Discussion

Take a poll asking their results of their estimates. For example, hold up a 1” ball and ask

- How many students had the correct estimate?
- How many estimated the ball was greater than 1”? If so, by how much?
- How many estimated the ball was less than 1”? If so, by how much?

Again holding up the 1” ball say the National Weather Service defines a severe thunderstorm as one containing:

- Hail size of 1” or larger, and/or
- Any wind speed 58 mph or greater and/or
- A tornado

The reason for the 1” was based upon the amount of damage produced by hail on an airplane.

Sizing Up Hail Student Worksheet

Name: _____

Estimate the size of each “hail stone” retrieved from the box. Select from the sizes listed in the table. You may need to use the same size more than once.

This is a chart listing the sizes you should use for this activity. Do NOT use this as a ruler.

SIZE											

- 1. 13.
- 2. 14.
- 3. 15.
- 4. 16.
- 5. 17.
- 6. 18.
- 7. 19.
- 8. 20.
- 9. 21.
- 10. 22.
- 11. 23.
- 12. 24.

The volunteer or member leading this activity will need to complete the table using the sizes represented in your personal hail box.

Sizing Up Hail ANSWER KEY for leader. Fill out before activity.

Label each object with a number. You can use as many objects in your box as you want. Be sure to record the size in inches of each object next to the corresponding number below. You may find it helpful to also list the name of the common object of the same size.

SIZE											
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- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
- 23.
- 24.

Estimating Hail Size with Common Objects Student Worksheet

Name: _____

Estimate the size of each item listed below. Select from the sizes listed in the table. You may use each size only ONCE.

SIZE	1/4"	1/2"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/2"	2 3/4"	3"	4"	4 1/2"
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HAIL SIZE	DESCRIPTION	HAIL SIZE	DESCRIPTION
	NICKEL		HALF DOLLAR
	PING PONG BALL		PEA
	TEA CUP OR HOCKEY PUCK		PENNY OR MILK DUD
	SOFTBALL		GRAPEFRUIT
	QUARTER		BASEBALL
	TENNIS BALL		HEN EGG OR LIME
	DIME OR PLAIN M&M		GOLFBALL

Estimating Hail Size with Common Objects - ANSWER KEY for leader

Estimate the size of each item listed below. Select from the sizes listed in the table. You may use each size only ONCE.

SIZE	1/4"	1/2"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/2"	2 3/4"	3"	4"	4 1/2"
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HAIL SIZE	DESCRIPTION	HAIL SIZE	DESCRIPTION
7/8"	NICKEL	1 1/4"	HALF DOLLAR
1 1/2"	PING PONG BALL	1/4"	PEA
3"	TEA CUP OR HOCKEY PUCK	3/4"	PENNY OR MILK DUD
4 1/2"	SOFTBALL	4"	GRAPEFRUIT
1"	QUARTER	2 3/4"	BASEBALL
2 1/2"	TENNIS BALL	2"	HEN EGG OR LIME
1/2"	DIME OR PLAIN M&M	1 3/4"	GOLFBALL

Report Your Hail to the National Weather Service (NWS)

Hail is an important indicator of a thunderstorm's strength. The NWS needs hail reports during and after the storm. What should you report? You should report the size of hail, time of day, and location hail was found. Be as specific as you can.

Activity

Place different sized balls around the rooms to indicate a hail event there. Put a sign with each hail event that lists a town the hail event took place and the time it took place. You can put more than one sized ball at an event. The size reported should always be the largest hail size found at the location.

You will find several "hail events" located around the room. Record what you would report to the National Weather Service in the table below. To report to the Norman NWS office, visit <http://www.srh.noaa.gov/StormReport/SubmitReport.php?site=oun>. To report to the Tulsa office, visit <http://www.srh.noaa.gov/StormReport/SubmitReport.php?site=tsa>.

	HAIL SIZE	TIME OF DAY	LOCATION
1			
2			
3			
4			
5			
6			



Mesonet
Oklahoma Weather Net

Portable Hail Scale

