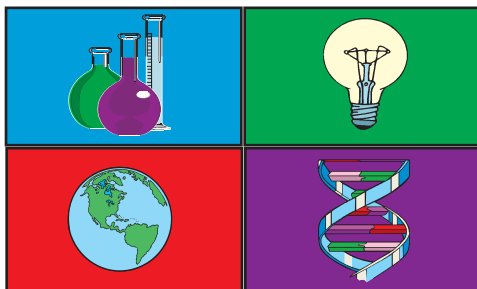


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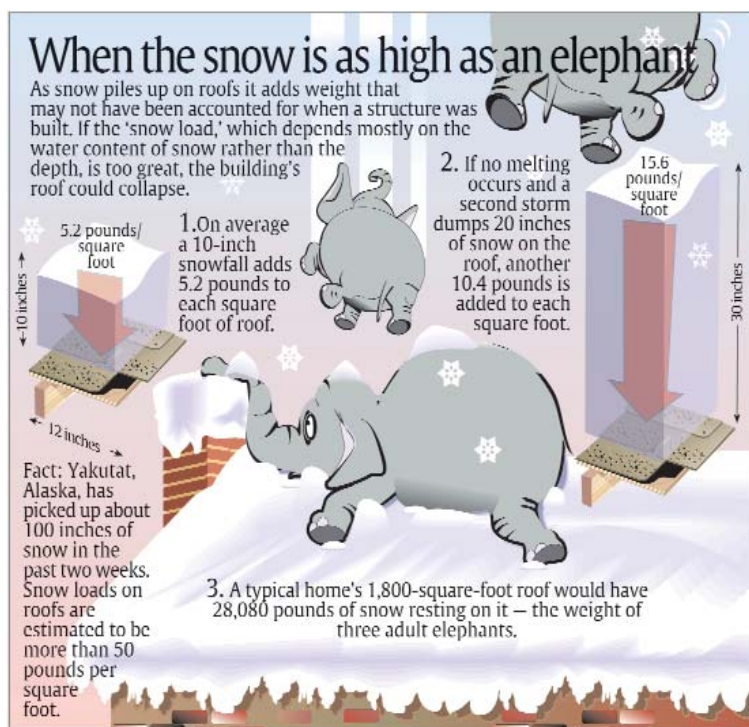
Student Edition

USA TODAY

NO. 1 IN THE USA



When the snow is as high as an elephant



Source: The Snow Booklet by Nolan J. Doesken and Arthur Judson

By Dave Merrill, USA TODAY

Focus Questions:

- One of the snowiest cities in the United States is Buffalo, New York. What is Buffalo's average snowfall over the last 15 years?
- What construction precautions must be taken in regions of the country where there is heavy snowfall?
- How does the density of snow compare to the density of water?
- How does the amount of snow that falls convert to liquid precipitation?

Activity Overview:

The winter months brings large amounts of snow in most states. Building snowmen, engaging in snowball fights, and hitting the ski slopes are ways for people of all ages to revel in the white stuff. However, snowfall causes some very real concerns for towns and for individual homeowners. Snow removal from roadways is a major expense for many cities, while snow removal from driveways and sidewalks is often a headache and a backache for residents. Snow is usually very heavy. After all, it is water, and water is a dense substance. When a large quantity of snow starts piling up on top of structures like houses, the weight is incredible. In this activity, you will examine data about snow, its density variability, snowfall averages in selected cities, and analysis of a record snowfall and some structural considerations for buildings.

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This activity was created for use with
Texas Instruments handheld technology.

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Procedure:

Step 1

Using the information in the table below, calculate the average annual snowfall for Buffalo, NY, since 1990. Enter the years in L1 and the snowfall in L2. As a suggestion, list the years as "1, 2, 3.....", rather than by actual year. Then calculate the average snowfall on the home screen of the calculator.

Year	Buffalo Snowfall (inches)
1990-91	57.5
1991-92	92.8
1992-93	93.2
1993-94	112.7
1994-95	74.6
1995-96	141.4
1996-97	97.6
1997-98	75.6
1998-99	100.5
1999-2000	63.6
2000-01	158.7
2001-02	132.4
2002-03	111.3
2003-04	100.9

Step 2

Create a scatter plot for the data and make note of any trends you see.

Step 3

The density of water is 1 g/cm^3 . This equates to 1000 kg/m^3 . Use the calculator's SciTools App to convert this measurement to pounds/cubic foot (lbs/ft^3). Hint: convert the mass/weight value first, and then convert the volume measurements.

Step 4

While water is water, snow differs in the amount of water it contains. Whereas 1" of rain is equal to 1" of water, 1" of fresh snow ranges from 7%-12% of this amount of water. Assume the snow that fell had 9% of the moisture content as rain water. Calculate the amount of snow that would have to fall to equal 1" of precipitation.

Step 5

Look at the USA TODAY Infograph "When the snow is as high as an elephant." Most household roofs are designed to withstand 20 lbs/ft^2 of weight. Use the data in the USA TODAY Infograph to calculate the amount of snow that a typical roof could tolerate.

Data Source:

The Snow Booklet by Nolan J. Doesken and Arthur Judson

Materials:

- TI-83 Plus family or TI-84 Plus family

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Assessment and Evaluation:

1. What is the average snowfall in Buffalo since 1990?

2. In the graph that you produced, what is the independent variable?

3. What is the dependent variable?

4. Was there a predictable trend in the snowfall data? Why or why not?

5. What is the density of water in lbs/ft³?

6. If a snowfall contained 9% of the moisture as rain, how many inches of snow would have to fall in order to equal 1" of moisture?

7. What would be the load in lbs/ft² on a roof covered with 1" of water?

8. Based on the data in the USA TODAY Infograph, what is the assumed moisture density of the snow?

9. Based on the data in the USA TODAY Infograph, how much snow could a home's roof tolerate before the critical point of 20 lbs/ft² were reached?

10. What factors could change your answer to #9?

11. Paradise, Washington is at the base of Mount Rainier. Paradise averages 635" of snow each year. In the winter of 1971-72, Paradise received an amazing 1122" of snow! How many feet of snow is this?

12. During the winter of 1971-1972, if all of the snow that fell on Paradise, Washington accumulated on the roof of a building, how much pressure in lbs/ft² would be exerted on that roof?

Student Notes: