

FLUIDS/ARCHIMEDES

Unit 18 Dr. John P. Cise, Professor of Physics, Austin Community

College, Austin Texas, USA, & New York Times, July 12, 2017, Dedicated to Roald Amundsen, a Norwegian who first reached South Pole first in December 1911. Amundsen got to Antarctica in sea strengthened ship called the "FRAM" on display in Oslo now.

How Big Is the Iceberg? That Depends on Where You Live

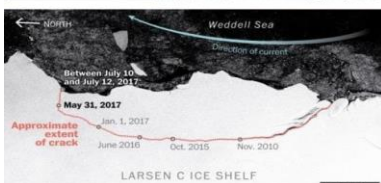
By DANIEL VICTOR JULY 12, 2017



The Larsen C ice shelf in Antarctica in February. A vast iceberg has broken off from the ice shelf, scientists said on Wednesday. An iceberg almost identical in size to Brunei broke away from the Antarctic Peninsula on Wednesday. You know what that looks like, right? Would it help if we said it was about twice the size of Samoa? Half as big as Gambia? One-tenth of Latvia? One-hundredth of Botswana? News organizations covering [the major scientific development](#) — it's one of the largest icebergs ever recorded and fundamentally changes the [Antarctic landscape](#) — had to hope their audiences knew geography well enough to understand the scope of the news. Several American outlets, including The New York Times, compared **the iceberg, at 2,240 square miles, to Delaware**, which has [1,954 square miles](#).

Antarctic ice shelf breaks

The Larsen C ice shelf calved a chunk of ice the size of Delaware early this week, a NASA satellite confirmed.



Sources: NASA, ESA Sentinel, Project MIDAS TIM MEKO AND DENISE LU/ THE WASHINGTON POST

INTRODUCTION: Goal of this application is to estimate the height (Δh) of this huge flat iceberg face above seawater. NASA measured iceberg volume to be twice lake Erie volume.

QUESTIONS: (a) Volume $V_{ERIE} = 115.2 \text{ mi.}^3$ from NASA. Find $V_{ICE} = ?$ in mi.^3 ?, (b) Find Thickness (h from bottom to top) of this huge flat iceberg if (as stated above) area $A = 2240 \text{ mi.}^2$? **NOTE: $V = A h$,** (c) Find depth (h' iceberg is in saltwater)? $h' < h$ (d) Find height ($h - h'$) = Δh of huge flat iceberg above water?

HINTS: ARCHIMEDES: Buoyant force (B) of displaced saltwater up equals weight of iceberg ($W_{ICEBERG}$),

$$B = W_{ICEBERG},$$

$$\rho_{SALT WATER} g V_{WATER DISPLACED} = \rho_{FRESH WATER ICE} g V_{ICE},$$

$$\rho_{SALT WATER} g A h' = \rho_{FRESH WATER ICE} g A h$$

Where $V_{WATER DISPLACED} = h' A$. $\rho_{SALT WATER} = 1030 \text{ kg./m}^3$, $\rho_{FRESH WATER ICE} = 910 \text{ kg./m}^3$

ANSWERS: (a) $V_{ICE} = 230.4 \text{ mi.}^2$, (b) $h = 0.10286 \text{ mi.}$, 543.3 ft., (c) $h' = 0.09087 \text{ mi.}$, 479.8 ft. (d) $\Delta h = \sim 63.5 \text{ ft.}$ cliff edge above sea water. That is the height of a six story building.

COMMENT: The pictures above seem to indicate this flat icebergs cliff face to be in this range of height above seawater surface $\sim \sim 63.5$ feet.