

The Gimli Glider

In 1983, Canada was in the process of switching from imperial units (such as pounds, feet and inches) to metric units. A new Air Canada plane used metric units only; the crew and the airport were more used to imperial. In calculating how much fuel was required, the units were mixed up and the calculations were done in pounds (lb) instead of kilograms. As there are 2.2 lb to the kg this meant that the plane had half as much fuel as the pilot thought that it did. When the fuel ran out half way through the flight the pilot had to land the plane, which was by now effectively a glider, on an abandoned air base. Incredibly, the only injuries were sustained by passengers leaving the plane.

The pilot calculated a fuel requirement of 22,300 kg for the trip that was to be made. A dipstick check showed that there were 7,682 litres already in the tanks.

In order to calculate how much more fuel was required, the crew needed to convert the quantity in the tanks to a weight in kg, subtract that figure from 22,300 kg and convert the result back to a volume.

In order to do this they needed to know the density of the jet fuel.

The correct density to use is: jet fuel = 0.803 kg/litre.

Calculation

1. Use the density of the jet fuel to calculate the mass in kg of the 7,682 litres of jet fuel already in the plane.
2. Subtract this from the fuel requirement for the journey of 22,300 kg.
3. Use your answer to Q2 and the density of jet fuel to calculate how many litres need to be put into the plane.

What went wrong, however, was that the crew used the incorrect density of jet fuel. They used 1.77 *pounds* per litre instead. This was the number on the paperwork and which was used by the airline for imperial measurements. (Although actually it is a mix of metric and imperial). Use the calculation below to show how this resulted in the plane having too little fuel.

4. Use the incorrect density of 1.77 to calculate the mass in 'kg' of the 7,682 litres of jet fuel already in the plane.
5. Subtract this from the fuel requirement for the journey of 22,300 kg.
6. Use your answer to Q5 and the density of 1.77 to calculate how many litres need to be put into the plane.

The captain checked the arithmetic, but also used the wrong density. None of them put units into their calculations and the result was that the plane had less than half the amount of fuel required for the journey.

The aftermath for the pilots

The captain was demoted for 6 months and the first officer suspended for 2 weeks. In spite of this, they were also given an international award for outstanding airmanship for managing to land a plane with no fuel and with no fatalities.