Problem of the Week
Problem A and Solution
Backpack Limit

Problem

Selma is going on a trip with her family. The airline allows each person's carry-on luggage to have a maximum mass of 10 kg. The clothes she wants to bring have a mass of 1.5 kg. She has three books that she wants to read. Two books are the same size, and each has a mass of 2 kg. The third book is 1500 g. She wants to bring her laptop and tablet as well. The laptop's mass is 2.3 kg. Her tablet's mass is 800 g. The shoes she needs for the trip are 1200 g. Her personal toiletries kit is 0.6 kg.

Can Selma bring everything she wants for the trip in her carry-on? Justify your answer.

Solution

It would be easier to calculate the total mass of the objects Selma wants to take if the individual masses were all measured in the same units. If we choose grams as the unit, all the masses in kilograms must be multiplied by 1000. Here are the objects' masses all in grams:

clothes: 1500, first book: 2000, second book: 2000, third book: 1500, laptop: 2300, tablet: 800, shoes: 1200, toiletries kit: 600

The sum of these masses is:
$$1500 + 2000 + 2000 + 1500 + 2300 + 800 + 1200 + 600 = 11900 \text{ g}$$

This is equal to 11.9 kg. According to the airline rules, this is too much weight for the carry-on luggage.

Teacher's Notes

Proper handling and conversion of units of measurement is very import in the real world. The metric system makes it easy to convert between units of the same category since you may simply multiply or divide by powers of 10 to do the conversions. However, not everyone in the world uses the metric system. Where different measurement systems are used, there may be problems.

In 1999, NASA sent a satellite to Mars that was intended to orbit the planet and send back climate information. The *Mars Climate Orbiter* was lost when its orbit became unstable and it burned up in the atmosphere surrounding Mars. The cause of the accident was human error. The force calculated in one part of the operating system was assumed to be in *pounds*, but in another part it was assumed to be in *newtons*. This incompatibility ended up with an incorrect amount of power given to the thrusters which led to the eventual destruction of the satellite. *(Source: wired.com)*.

In 1983, an Air Canada flight ran out of fuel on its way from Toronto to Edmonton. The flight specifications had indicated that the aircraft required an amount of fuel in kilograms. However, the ground crew pumped the amount given in pounds. Since one pound is less than one-half a kilogram, the flight had much less fuel than it required. Luckily the pilots landed the aircraft safely, with no engine power, at a closed air force base in Manitoba. *(Source: wikipedia.org)*