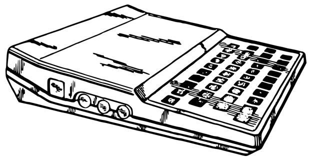

Problem of the Week
Problem A and Solution
Fund Raising

Problem

Room 9 is raising funds for a tree-planting charity by recycling electronics. They have found a local company that will give them \$1 for each pound of computer e-waste and \$2 for each pound of cell phone e-waste.

The school only has metric measuring tools. Here is what they have gathered to recycle:

Computers

- 6 Bonobo laptops: 800 g each
- 4 uPads: 600 g each
- 2 HomeBooks: 1.2 kg each

Cell Phones

- 2 uPhones: 375 g each
- 4 Mixel phones: 100 g each

Knowing that 1 pound is approximately 454 g, find an estimation of how much money Room 9 will make. Justify your answer.

Solution

Solutions may vary, possibly resulting in different final approximations. We are going to show three possible solutions. In each solution we will use the following information:

Since 1 pound is approximately 454 g and 500 g is 0.5 kg, then 1 pound is approximately 0.5 kg. So,

0.5 kg is approximately 1 pound, and 1 kg is approximately 2 pounds.

Solution 1: We will look at first approximating the mass of each item.
Knowing this, we can estimate the total mass of the e-waste that was gathered, and then calculate how much it is worth.

Computers:

- Bonobo laptops: Since each laptop is approximately 1 kg, six Bonobo laptops are approximately 6 kg.
- uPads: Since each uPad is approximately 0.5 kg, four uPads are approximately 2 kg.
- HomeBooks: Since each HomeBook is approximately 1 kg, two HomeBooks are approximately 2 kg.

This is approximately $6 + 2 + 2 = 10$ kg of computer waste.
Since each 1 kg is approximately 2 pounds, then there is approximately $10 \times 2 = 20$ pounds of computer waste.

The computer e-waste is worth approximately \$20.

Phones:

- uPhones: Since each uPhone is approximately 0.5 kg, two uPhones are approximately 1 kg.
- Mixel phones: Since each Mixel phone is 100 g, then four Mixel phones are 400 g, or approximately 0.5 kg.

This is approximately $1 + 0.5 = 1.5$ kg of cell phone waste.
Since each 1 kg is approximately 2 pounds, then there is approximately $1.5 \times 2 = 3$ pounds of cell phone waste.

The cell phone e-waste is worth approximately \$6.

So the total value is approximately $\$20 + \$6 = \$26$.

Solution 2: Since there are a small number of items for each waste product, we will find the mass for each specific waste product in kg and then approximate the mass in pounds.

Computers:

- Bonobo laptops: Since each laptop is 800 g, then six laptops are $6 \times 800 = 4800$ g. Therefore, six Bonobo laptops are approximately 5 kg.
- uPads: Since each uPad is 600 g, then four uPads are $4 \times 600 = 2400$ g. Therefore, four uPads are approximately 2.5 kg.
- HomeBooks: Since each HomeBook is 1.2 kg, then two are $2 \times 1.2 = 2.4$ kg. Therefore, two HomeBooks are approximately 2.5 kg.

This is approximately $5 + 2.5 + 2.5 = 10$ kg of computer waste.
Since each 1 kg is approximately 2 pounds, then there is approximately $10 \times 2 = 20$ pounds of computer waste.

The computer e-waste is worth approximately \$20.

Phones:

- uPhones: Since each uPhone is 375 g, then two uPhones are $2 \times 375 = 750$ g. Therefore, two uPhones are approximately 1 kg.
- Mixel phones: Since each Mixel phone is 100 g, then four Mixel phones are $4 \times 100 = 400$ g. Therefore, four Mixel phones are approximately 0.5 kg.

This is approximately $1 + 0.5 = 1.5$ kg of cell phone waste.
Since each 1 kg is approximately 2 pounds, then there is approximately $1.5 \times 2 = 3$ pounds of cell phone waste.

The cell phone e-waste is worth approximately \$6.

So the total value is approximately $\$20 + \$6 = \$26$.

Solution 3: In this third solution, we will find the total mass of computer waste in kg and the total mass of cell phone waste in kg, and then approximate these totals in pounds.

Computers:

- Bonobo laptops: Since each laptop is 800 g, then six laptops are $6 \times 800 = 4800$ g.
- uPads: Since each uPad is 600 g, then four uPads are $4 \times 600 = 2400$ g.
- HomeBooks: Since each HomeBook is 1.2 kg, then two are $2 \times 1.2 = 2.4$ kg, which is equal to 2400 g.

Therefore, there is $4800 + 2400 + 2400 = 9600$ g, which is equal to 9.6 kg. Therefore, there is approximately 9.5 kg of computer waste.
Since each 0.5 kg is approximately 1 pound, then there is approximately $9 \times 2 + 1 = 19$ pounds of computer waste.

The computer e-waste is worth approximately \$19.

Phones:

- uPhones: Since each uPhone is 375 g, then two uPhones are $2 \times 375 = 750$ g.
- Mixel phones: Since each Mixel phone is 100 g, then four Mixel phones are $4 \times 100 = 400$ g.

Therefore, there is $750 + 400 = 1150$ g, which is approximately 1 kg. Since each 1 kg is approximately 2 pounds, then there is approximately 2 pounds of cell phone waste.

The cell phone e-waste is worth approximately \$4.

So the total value is approximately $\$19 + \$4 = \$23$.

Teacher's Notes

Did you know that a kilogram is not what it used to be?

Like many units of measurement, the definition of a kilogram was linked to a physical model. In 1795, French law defined a kilogram as the mass of 1000 cubic centimetres (or 1 litre) of water. In 1799, a physical prototype was commissioned and stored at the Archives Nationales in Paris. At the time, this platinum cylinder was the standard for a kilogram.

Over time, the physical model would not necessarily be exactly the same as when it was commissioned. In 1879, the definition of a kilogram was updated to be the mass of 1 dm^3 of water under atmospheric pressure and maximum water density, which is measured at approximately 4 degrees Celsius. At that time a new platinum-iridium prototype was commissioned and stored at the Archives Nationales.

In May 2019, the International Bureau of Weights and Measures announced the new official definition of a kilogram. It changed from a physical model to a mathematical definition based on universal constants: *Planck's constant*, the speed of light, and the radiation generated by a cesium atom. This relatively recent update makes the kilogram the last unit of measurement in the International System of Units (SI) to be linked to a physical artifact.

Sources: Wikipedia and nist.gov