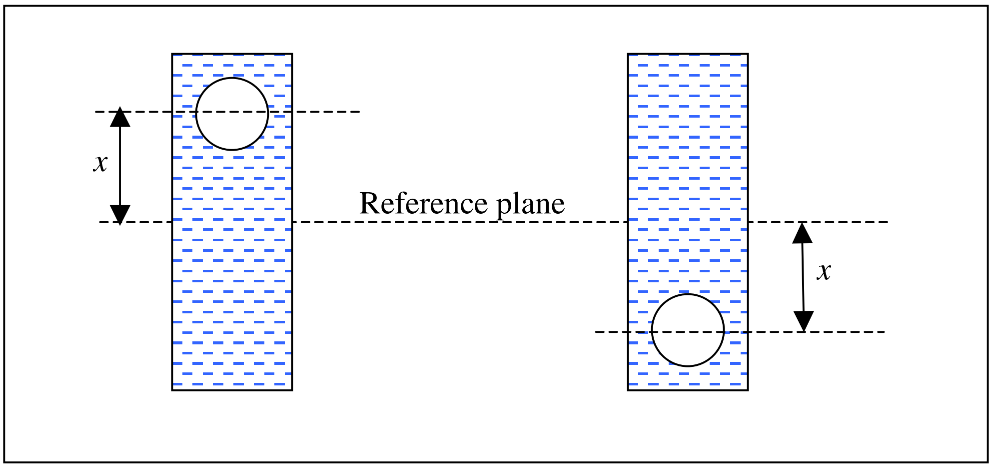
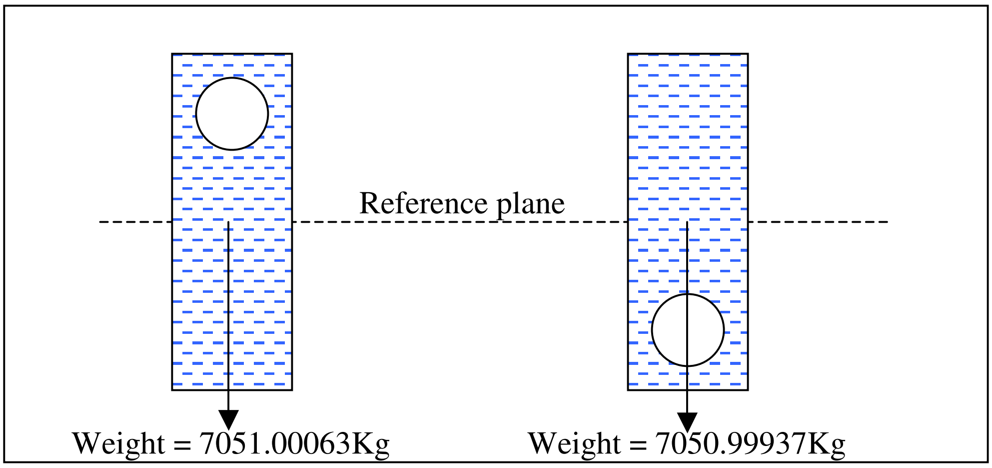
Proof for Tinman's Gravity Machine.

Here are the two situations for Tinman's system before launch and after return to earth.



We will take the reference plane as the geometric centre of the tubes. We will take the total mass of the tubes completely filled with water as *M*. We will take the mass of water needed to fill the spheres as m. Thus the actual mass is close to *M-m* but we also want to take account of the distance *x* of the spheres from the centre line. Gravity follows an inverse square law so we can write for the force on a tube completely filled with water as $F_M = \frac{KM}{R^2}$ where *K* is a constant and *R* is the distance from our reference plane to the centre of the earth. But the tube has an amount *m* missing and the force on that missing part of the LH tube would be $F_m = \frac{Km}{(R+x)^2}$. Thus the actual force F_{LH} on the tube is $F_{LH} = \frac{KM}{R^2} - \frac{Km}{(R+x)^2}$. This is very slightly different to the downward force on the normally assumed actual mass *M-m* because we assume that gravity is uniform within our laboratories, but it isn't. It's only a tiny tiny difference but when taken over the vast distances used by Tinman to get to outer space where gravity is reduced to one tenth it becomes significant. By the same argument the downward force F_{RH} on the RH tube is $F_{RH} = \frac{KM}{R^2} - \frac{Km}{(R-x)^2}$. These two slightly different forces are shown in the next figure as Kg weight, using Tinman's 7500Kg for *M* and 449Kg for *m*.



Now let's see what those slightly different weights mean when calculating the energy needed to raise them to outer space where gravity is one tenth. Clearly we expect the slightly greater weight to need slightly more energy, and this means that we cannot assume that the energy needed to reach outer space is exactly equal to the energy gained when falling back to earth.

Because of the inverse square law the distance from the earth's centre to get one tenth the gravity force is $\sqrt{10} \times R$ so the energy W_{LH} needed to raise the LH tube to that height is given by the definite integral

$$W_{LH} = \int_{R}^{R\sqrt{10}} \left[\frac{KM}{r^2} - \frac{Km}{(r+x)^2} \right] .dr \qquad (1)$$

By the same argument the energy W_{RH} needed to raise the RH tube to that height is given by

$$W_{RH} = \int_{R}^{R\sqrt{10}} \left[\frac{KM}{r^2} - \frac{Km}{(r-x)^2} \right] .dr \qquad (2)$$

The difference between (1) and (2) is

$$W_{DIFF} = \int_{R}^{R\sqrt{10}} \left[\frac{Km}{(r-x)^2} - \frac{Km}{(r+x)^2} \right] .dr \qquad (3)$$

which is independent of the mass *M*.
Solving the integral yields

$$W_{DIFF} = Km \left[\frac{1}{r-x} - \frac{1}{r+x} \right]_{R}^{R\sqrt{10}}$$

Taking to a common denominator

$$W_{DIFF} = Km \left[\frac{(r+x)-(r-x)}{(r-x)(r+x)} \right]_{R}^{R\sqrt{10}}$$

$$W_{DIFF} = Km \left[\frac{2x}{r^2 - x^2} \right]_{R}^{R\sqrt{10}}$$

Because $r >> x$ over the integration range we can use the very good approximation

$$W_{DIFF} \approx Km \left[\frac{2x}{r^2} \right]_{R}^{R\sqrt{10}}$$

Yielding

$$W_{DIFF} = \frac{2Kmx}{R^2} \left(\frac{1}{10} - 1 \right)$$

$$W_{DIFF} = \frac{-2Kmx}{R^2} \left(\frac{9}{10} \right)$$

But $\frac{K}{R^2}$ is earth's acceleration of 9.81m/s^2 hence this energy difference is 9/10 of the buoyancy energy retrieved when the ball rises the distance 2*x* at the final count. Put another way the energy needed to raise the system to that outer space region is nine tenths of that buoyancy energy greater than the energy reclaimed on the fall from that region. Add to that loss the one tenth needed to pull the ball down when at that outer space region and we find that all the energies are accounted for.