**Denver Area Physics Teachers Energy Balance**

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One nice way to show the reason energy is important and can make physics easier is with an energy balance. I made my energy balance some time ago but it is quite easy to reproduce. Dimensions are not critical.

**Materials**

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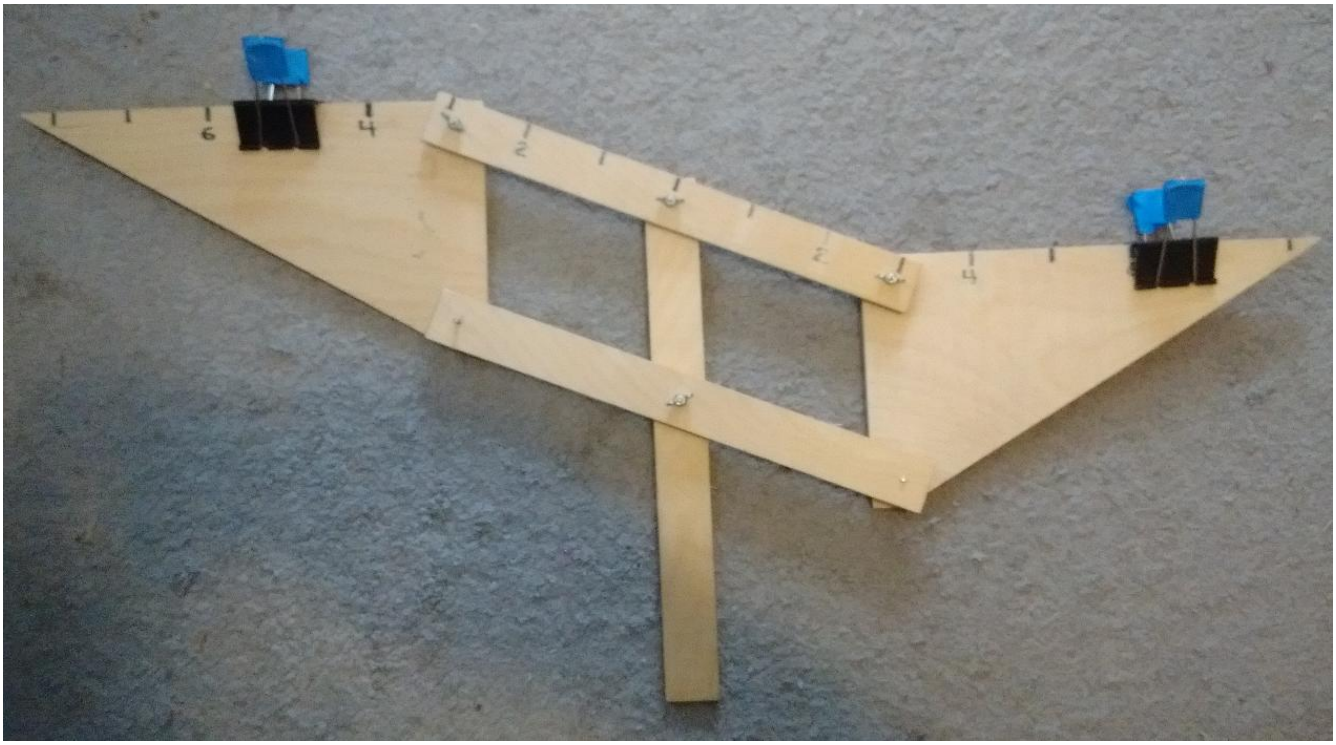
| 3 | slats about 13 inches long (two horizontal and one vertical) |
| 2 | triangular pieces about 6 inches high and 12 inches long. |
| 6 | #6 screws with a nut and wingnut on each |
| 2 | equal weights (binder clips with quarters taped to the handles work well) |

For my balance I used three thin slats are about 1.25 inches wide and 13 inches long. I used ¼ inch plywood but MDF or even corrugated cardboard would work. The triangular shapes are about 6 inches high and 12 inches long. Each pivot point is a 1 inch #6 screw. It is loosely held in place by #6 nuts to the triangular pieces and center slat. I then used #6 wing nuts to loosely hold the apparatus together. The wing nuts allow the apparatus to easily be taken apart and stored in a very small box. For weights I have traditionally used 100g slotted weights but large binder clips with a couple of quarters taped to the handles as shown below also work very well.



**Explanation**

The reason I like this apparatus is that most students have an idea of how a balance works. Two identical weights equal distance from the fulcrum will balance but if one is further from the fulcrum than the other the balance will go down on the far side. This apparatus works as expected when the weights are positioned at points 1,2 or3.

However when the weighs are positioned at points 4,5,6,7 or 8 the apparatus will balance at any position. Energy makes the apparatus very easy to explain while traditional explanations (forces and lever arms etc) are complicated and difficult.

Systems generally will move towards lowest energy. When a weight is at position 1 on one side and another weight is at position 2. Since the weight at position 2 goes down and loses twice the energy as the weight at position 1 gains when it goes up, there is an overall loss of energy. Because of the geometry of the apparatus the two triangular pieces remain parallel to the ground The energy lost by one weight is equal to the energy gained by the other and therefore the apparatus will remain in balance at any position.

The operation of this apparatus is exactly why it is not important where the weights are placed on a traditional two pan balance.

I think this type of activity is really important since students will always revert to what they have already learned and will not easily be convinced to utilize a new concept unless they are shown why the new concept is important and can make things easier. Energy makes things easier that traditional statics and dynamics.