Conservation of Energy - Teacher Notes

First of all, this worksheet calls "total energy" "mechanical energy" instead. Anytime you see "ME" or "mechanical energy", you know the handout is referring to "TE" or 'total energy".

When looking at problem #1 - you may be feeling overwhelmed. How do I solve for all of these quantities? Where do I even begin? In any problem, you should start with *what is given to you* and *what you can solve for.* In this problem, we are given mass and starting velocity (or speed). We can use that to solve for Kinetic Energy. Start by solving for KE at position 1.

$$KE = \frac{1}{2}(60)8^2)$$
$$= 30(64)$$
$$= 1920J$$

Now that we know the amount of KE, go ahead and write it in the blank for "KE" on your worksheet. Now lets think about this problem conceptually. What do we know about GPE when objects are at a height of zero? We know that any number times zero IS zero, so we know that GPE at position 1 will be zero.

$$GPE = 60(10)(0)$$
$$= 0\ J$$

Go ahead and write that in on the blank for "PE" on your worksheet. So what's our total energy in this system? Its the combination of PE and KE, so for position 1, it is equal to KE, so go ahead and write "1920 J" on the line for "ME" (which stands for mechanical energy, but remember that's the same as total energy).

We also know that TOTAL ENERGY NEVER CHANGES IN A SYSTEM. So go ahead and fill in "1920 J" for "ME" throughout problem 1.

Now let's look at position 2. We know TE is 1920. We also know the skater is at height 1m. We also know that as the skater moves up the ramp, they will slow down, so the amount of KE will decrease. That KE will be converted to GPE as the position of the skater gets higher and higher above Earth. So we know the mass, we know g=10 on Earth, and we know height. Let's solve for GPE at position 2.

$$GPE = 60(10)(1)$$
$$= 600\ J$$

Go ahead and add 600 J to the blank for "PE" on your handout. Knowing total energy and GPE, we can solve for KE. KE is the difference between total energy and PE. Go ahead and do that math:

$$1920 = KE + 600$$
$$1320 = KE$$

And write 1320 J in the blank for KE on your handout. Now, you are asked to solve for velocity. We can use the KE equation. Just like in math class, you can solve for any unknown variable in the equation, as long as you know the values for the other variables. So we can now substitute and solve for "v" at position 2.

$$\frac{1320}{30} = \frac{\frac{1}{2}(60)\,v^2}{30}$$

$44 = v^2$ this is velocity SQUARED!

Don't forget to take the square root when using KE to solve for velocity.

$\sqrt{v^2} = \sqrt{44}$

$v = 6.6\ m/s$

Go ahead and add 6.6 m/s in the spot for "v" on your handout. You will solve the rest of the problems in this packet, as well as the problems from yesterday's packet, in a similar way.

ADDITIONAL NOTES ON THIS PACKET:

Looking at problem 1, position 3, assume the height = 3 m.

Problem 2: assume STARTING velocity is 0 m/s

SKIP Problem 3 entirely

Problem 5: a. Is "Work" and e. Is "Force"