

Energy Transformations

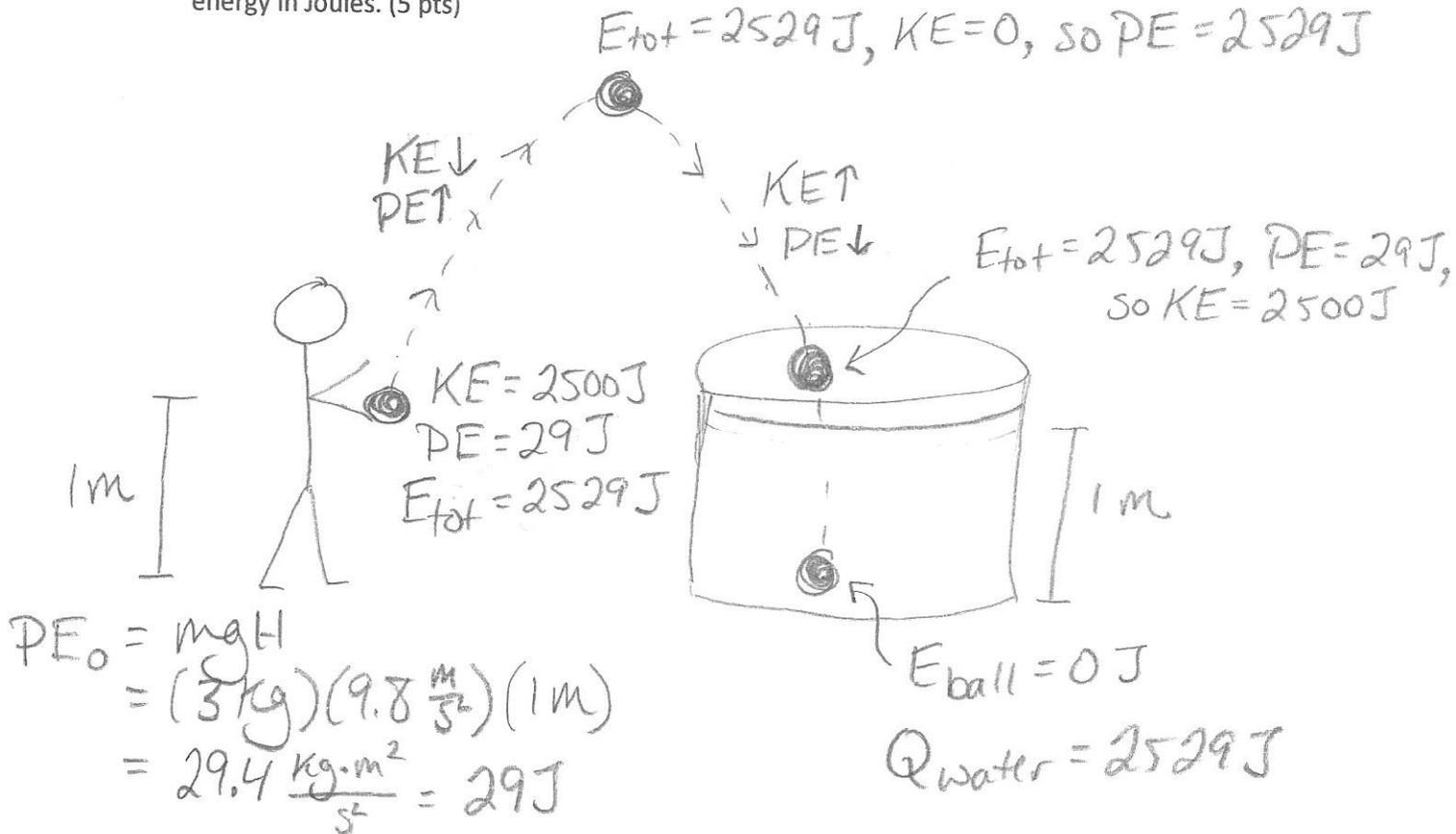
Directions: Work with a partner to fill in all sections below. This will be handed in at the end of class.

A 3 kg ball is thrown upward with an initial kinetic energy of $KE=2500\text{ J}$. Its velocity decreases until it comes to a stop, then begins to fall again. It falls into an insulated pool containing 3000 kg of water, whose surface is 1m above the ground. In your calculations, assume no energy is lost to air resistance (perfect energy conversion).

Some useful quantities: Kinetic energy $KE = \frac{1}{2} mV^2$
 Potential energy $PE = mgH$
 Thermal energy $Q = m C_p \Delta T$

1. Draw a diagram to show the path of the ball. Label the following points: (5 pts)
 - a. The throwing point (on the ground)
 - b. The top of the ball's path
 - c. The pool surface
 - d. The bottom of the the pool

2. Decide which type(s) of energy the ball possesses at each point. Write the type and the total energy in Joules. (5 pts)



3. Find the height to which the ball rises before it begins to fall into the pool. Show all calculations WITH UNITS. Label the height on your diagram. (5 pts)

At the top, $PE = 2529 \text{ J}$. Solve $PE = mgh$ for H .

4. Just as the ball is about to fall into the pool, what is its velocity? Show all calculations WITH UNITS. Write the velocity in the appropriate location on your diagram. (5 pts)

Just above the pool, $KE = 2500 \text{ J}$.
Solve $KE = \frac{1}{2}mv^2$ for v , then substitute.

5. If the 3000 kg of water in the pool absorbs all the kinetic energy of the ball, what will be the temperature change of the water in $^{\circ}\text{C}$? The specific heat of water is $C_p = 1 \text{ cal/g}^{\circ}\text{C}$, and 1 cal is equivalent to 4.2 J. (5 pts)

The pool water absorbs all 2529 J of energy, so
 $Q = 2529 \text{ J}$. Solve $Q = mC_p\Delta T$ for ΔT .