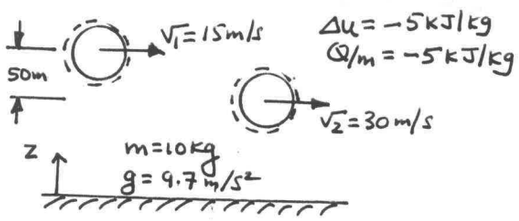
PROBLEM 2.55

KNOWN: Data is provided for a 10kg mass undergoing a process.

FIND: Determine the work for the process of the mass.

SCHEMATIC & GIVEN DATA:



ENGR. MODEL

1. The 10kg mass is the closed system.
2. The acceleration of gravity is constant.

ANALYSIS:

$$\Delta U + \Delta KE + \Delta PE = Q - W \Rightarrow W = Q - \Delta U - \Delta KE - \Delta PE$$

✓ $Q = m\left[\frac{Q}{m}\right] = 10\,kg\left[-5\frac{kJ}{kg}\right] = -50\,kJ$

✓ $\Delta U = m\,\Delta u = 10\,kg\left[-5\frac{kJ}{kg}\right] = -50\,kJ$

✓ $\Delta KE = \frac{m}{2}\left[V_2^2 - V_1^2\right] = \frac{10\,kg}{2}\left[\left(30\frac{m}{s}\right)^2 - \left(15\frac{m}{s}\right)^2\right]\left|\frac{1N}{1kg\cdot m/s^2}\right|\left|\frac{1kJ}{10^3 N\cdot m}\right| = +3.38\,kJ$

✓ $\Delta PE = mg(z_2 - z_1) = (10kg)(9.7 m/s)(-50m)\left|\frac{1N}{1kg\cdot m/s^2}\right|\left|\frac{1kJ}{10^3 N\cdot m}\right| = -4.85\,kJ$

$\therefore W = (-50kJ) - (-50kJ) - (+3.38kJ) - (-4.85kJ)$

$= +1.47\,kJ$ ←