Problem 1: **Ch 10 p.256 #24**

Name: Solution

Type of problem: Analysis of Potential Energy Diagram

Verbal Analysis for parts a, b, and c

The graph shows U as a function of X. If a particle is released at rest at some position X, the direction it will move is determined by the direction of the force it experiences. The force at a position is related to the U(x) function by $F = -\frac{dU(x)}{dx}$, which is the negative slope of the U(x) graph. If the force is positive, the object will move right, if negative it will move left.

The maximum speed will occur when the potential energy is a minimum. This because $E_T = K + U$, and total energy is constant, so as U gets smaller, K gets bigger, and speed is related to K by $K = \frac{1}{2}mv^2$.

The total energy can be found by knowing K and U at some position X, and $E_T = K + U$.

Turning points occur when all the energy, E_T, is potential. At these positions, $E_T = K + U$ becomes $E_T = U$. These occur when the U line on the graph crosses the E_T line.

Solution for parts a, b, and c

a) -Slope = F

slope is negative at x=1, so Force is +, and particle moves right.

b) max speed occurs at x=4m

$E_T = K + U$ at x=4m

$4J = \frac{1}{2}mv^2 + 1J$

$3 = \frac{1}{2}(.020kg)v^2$

$17\,m/s = v$

Find total energy at x=1, $E_T = K + U$

$= 0 + 4J$

$= 4J$

c) x=1m and x=6m because $U = E_T$, so particle is at rest, and the force will make it go the other direction