Name açar

U4: Homework Questions #2

Work/Energy/Power

1. A weight lifter lifts a mass m at constant speed to a height h in time t. How much work is done by the weight lifter?

   a. mg
   b. mh
   c. mgh
   d. mght
   e. mgh/t

$F_A = mg$ $\quad F\Delta x = mgh$

$\Delta x = h$

2. When an object is moved from rest at point A to rest at point B in a gravitational field, the net work done by the field depends on the mass of the object and

   a. the positions of A and B only
   b. the path taken between A and B only
   c. both the positions of A and B and the path taken between them
   d. the velocity of the object as it moves between A and B
   e. the nature of the external force moving the object from A to B

Work is a state function

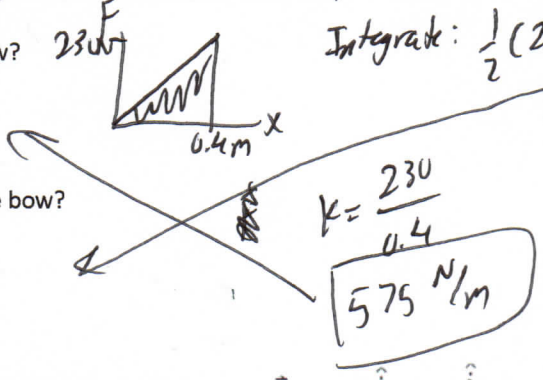
3. An archer pulls her bowstring back 0.40 m by exerting a force that increases uniformly from zero to 230 N.

   (a) What is the equivalent spring constant of the bow?

   575 N/m

   (b) How much work does the archer do in pulling the bow?

   46 J



4. A force $\vec{F} = (4.00\,\hat{i} - 1.00\,\hat{j})$ N acts on a particle that undergoes a displacement $\Delta\vec{r} = (2.00\,\hat{i} + 1.00\,\hat{j})$ m.

   a. Find the work done by the force on the particle.

   7.0 J $\quad F \cdot r = 7$

   b. What is the angle between $\vec{F}$ and $\Delta\vec{r}$?

   40.6 °

$\frac{F \cdot r}{\|F\|\|r\|} = \cos\theta$ $\quad \theta = 40.6$

5. A 1.4 kg block is initially moving at 3.00 m/s to the right when it is located at $x = 0.0$ m on a horizontal frictionless surface. A horizontal net force in the positive x-direction is applied to the block. The force is given by $F(x) = ([2.7\ N] - [2.80\ N/m^2]\ x^2)$ N, where x is in meters and the initial position of the block is $x = 0$.

(a) What is the work done by the net force as the block moves from $x = 0.0$ to 2.0 m?

-2.07 J

$\int_0^2 F(x) = -2.04J$

(b) What is the kinetic energy of the block as it passes through $x = 2.0$ m?

4.23 J

$\frac{1}{2}mv^2 = \frac{1}{2}(1.4\,kg)(9\,m/s) = 6.3J$

$6.3J - 2.04J = 4.26J$

(c) What is the speed of the block when it passes through $x = 2.0$ m?

2.46 m/s

$\frac{1}{2}(1.4)(v^2) = 4.26$

$v = 2.46\ m/s$

6. Jane, whose mass is 50.0 kg, needs to swing across a river of width D filled with crocodiles to save Tarzan from danger. She must swing into a wind exerting constant horizontal force F, on a vine having length L and initially making an angle Θ with the vertical. Take $D = 50.0$m, $F = 110$ N, $L = 40.0$ m, and $\Theta = 50$ degrees.

Height:

Left:

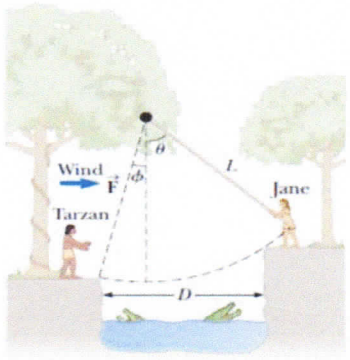
$H_T = L - L\cos\theta$

$H_T = 4.99m$

Right

$H_J = L - L\cos\theta$

$H_J = 14.3m$



$D = L\sin\theta + L\sin\theta$

$\theta = 28.9°$

a. With what minimum speed must Jane begin her swing to just make it to the other side?

6.20 m/s

$Ek_J + Ug_J - W_w = Ug_T$

$v = 6.2\ m/s$

b. Once the rescue is complete, Tarzan and Jane must swing back across the river. With what minimum speed must they begin their swing? Assume Tarzan's mass to be 80 kg.

9.90 m/s

$Ek_T + Ug_T + W_w = Eg_J$

$v = 9.9\ m/s$