Work & energy

Problems

How to Solve the work Problems

1) *First Draw Nice diagram of Situation and show all the forces acting the system with vector*
2) *Draw the Free body diagram for each body in the system and show all the forces acting on it with nice vector*
3) *Use Newton's law to find any unknown force*
4) *Now apply the below Equation for each force acting on the body to obtain the work done by the force*

   W=F.S(Vector Dot Product of force and Displacement)

   W=Fscosθ

5) *Calculate the net work done by doing the sum of the individual work done*

   $W=W_1+W_2+\ldots\ldots$

6) *Work done can be positive or negative*
7) *Work done by variable force*

$$W = \int F.dx$$

Question 1:

A object of 10 kg is pulled across the floor a distance 10m by a horizontal
force. The coefficient of friction between the block and floor is .30
There is no change in speed of the body across the motion
a) Find the work done by the pulling force.
b) find the work done by the frictional forces
c) find the net work done

Solution

1) First get a clear picture of the motion
2) There are two forces acting on the body in opposite direction

a) Pulling force in the direction of motion

b) Friction force in the direction opposite to motion

3) Now we need to find the pulling force. The speed is constant, thus Newton law give

F=-f where f is frictional force

Now f=μmg=.3*10*10=30N ,So F=30 N

Continued

a) Work done by the Pulling force

$W_1 = Fd\cos\theta = 30X10(\cos 0) = 300$ N

b) Workdone by the Frictional Force

$W_2 = Fd\cos\theta = 30X10(\cos 180) = -300$ N

c) Net work done

$W = W_1 + W_2 = 300 - 300 = 0$ N

Question 2: A Body of mass m start from origin along X axis by a variable force F=Ax .Find the work done by the variable force when it reaches x=d

Solution: This is an example of variable force

$$W = \int F.dx$$

$$W = \int_0^d Axdx = \frac{1}{2}Ad^2$$