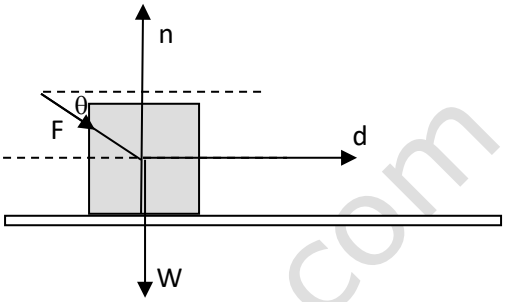
Q- A block of mass 2.50-kg is pushed 2.20 m along a frictionless horizontal table by a constant 16.0-N force directed 30^0 below the horizontal. Determine the work done by (a) the applied force, (b) the normal force exerted by the table, (c) the force of gravity, and (d) the net force on the block.

(Acceleration due to gravity g = 9.8 m/s^2)



The forces acting on the block are

(1) The weight of the block

W = mg = 2.50*9.8 = 24.5 N

(2) The normal force of the surface n

(3) The force applied

F = 16.0 N

The weight W of the block is vertically downward means in negative y direction. The normal force n is acting on the block vertically up and in positive y direction.

The force F is making an angle $\theta = 30.0^0$ bellow horizontal as shown.

(a) The work done by the applied force F is given by

$$W_F = \vec{F}.\vec{d} = F\ d\cos\theta = 16.0 * 2.20 * \cos 30° = 16.0 * 2.20 * 0.866 = 30.48\ J$$

(b) The normal force exerted by the table is vertically upward and the displacement is in horizontal and hence the angle between them is 90^0. The work done by the normal force is given by

$$W_n = \vec{n} \bullet \vec{d} = n.d.\cos\theta = n * 2.20 * \cos 90^0 = n * 2.20 * 0 = 0$$

Hence no work is done by the normal force on the block.

(c) The weight of the block (the force of gravity) is vertically downward and the displacement is in horizontal and hence the angle between them is 90^0. The work done by the weight is given by

$$W_W = m\vec{g} \bullet \vec{d} = mg.d.\cos\theta = 2.50 * 9.8 * 2.20 * \cos 90^0 = 24.5 * 2.20 * 0 = 0$$

Hence no work is done by the normal force on the block.

(d) The applied force can be resolved in two mutually perpendicular x and y directions. As the force is making angle $\theta = 30.0^0$ bellow horizontal the components are

$F_x = F\cos\theta$ and $F_y = F\sin\theta$

As the block is not moving in vertical direction, all the forces in vertical direction are balances to resultant zero and hence the net force will be in horizontal direction only

As the only horizontal force is the horizontal component of the applied force hence the resultant (net) force acting on the block will be

$F_R = F_x = F\cos\theta = 16.0*\cos 30.0^0 = 16.0*0.866 = 13.86$ N