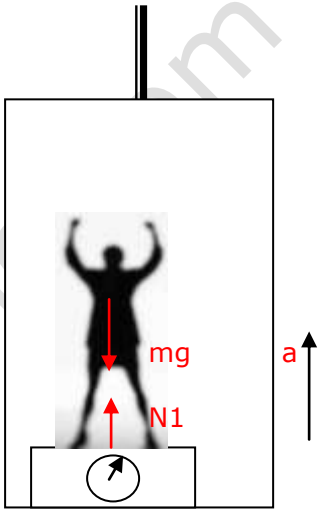
Q- A man with mass m=75kg is standing on a scale in an elevator. Find what the scale shows in the following two situations.
(a) The elevator is going up while speeding up at $2m/s^2$
(b) the elevator is going down while slowing down at $2m/s^2$

The scale reads the weight or the force acting on it.

When the elevator is at rest or moving with uniform velocity, net force on him should be zero and thus his weight mg is balanced by the normal force N (upward) of the elevator. Hence the reactionary force, equal and opposite to N will act on the scale downward gives the same reading as the weight of the man.

a) The elevator is going up while speeding up at $2m/s^2$



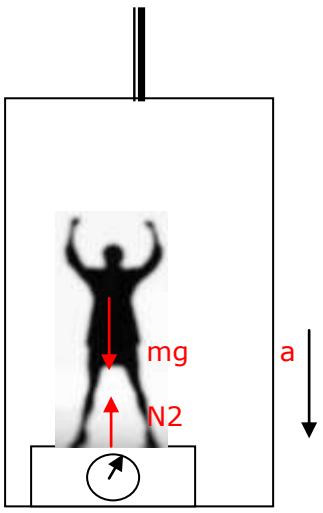
In this case the elevator is moving up with an acceleration a = 2 m/s^2 and the same will be for the man. The normal force N_1 will be such that it balances the weight of the man as well as accelerates it up with the same acceleration and hence according to the Newton's law the equation of motion can be written as (upward positive)

$F = ma$
Or $N_1 - mg = ma$

Gives $N_1 = mg + ma = m(g + a) = 75*(9.8 + 2) = 885$ N

Hence the scale will read $N_1 = 885$ N = 885/9.8 Kg = 90.31 Kg

(b) The elevator is going down while slowing down at $2m/s^2$



In this case the elevator is moving down with a downward retardation a = - 2 m/s^2 means its acceleration is upward and the same will be for the man. The normal force N_2 will be such that the resultant of weight of the man and the normal force will accelerates it with the same acceleration and hence according to the Newton's law the equation of motion can be written as (upward positive)

$F = ma$
Or $N_2 - mg = ma$

Gives $N_2 = mg + ma = m(g + a) = 75*(9.8 + 2) = 885$ N

Hence the scale will read $N_1 = 885$ N = 885/9.8 Kg = 90.31 Kg

(same reading as in both cases the acceleration vector is in upward direction)